the OIL AND GAS JOURNAL
PUBLISHED WEEKLY DECEMBER 11, 1961

THOSE RUSSIAN EXPORTS

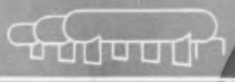
Official soviet figures show a 42% increase to the free world – at prices only half of those charged the satellite nations 64

The market: Really rough but not ruinous 46

Imports battle must be fought all over again 50

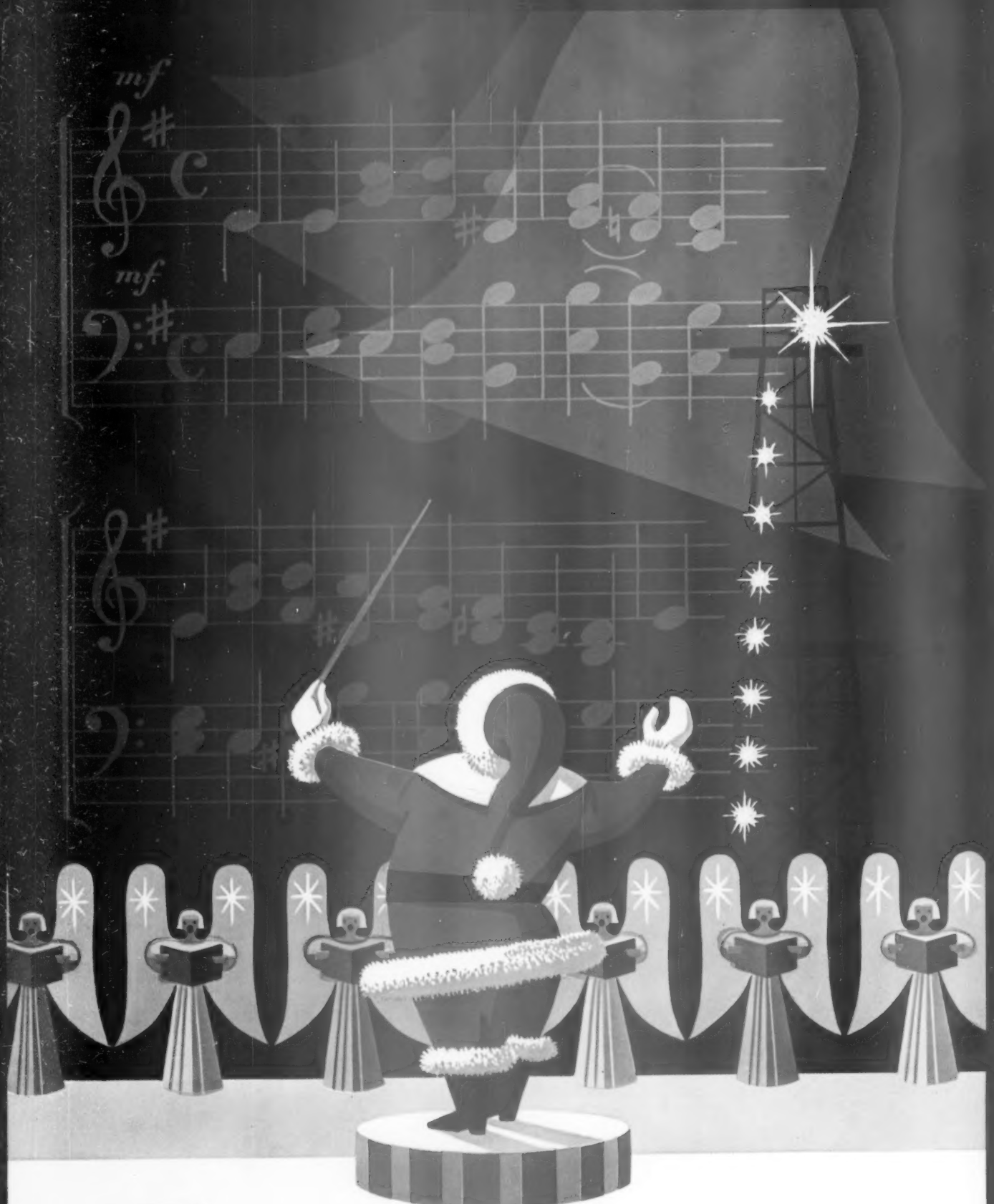
Problem in oil:

To bring order to a disorderly transition 69



Are miscible drives worth their cost? p 43

Results have been so poor that plain economics now seems to favor water flooding. New ideas are being tried, but even these may require incentive allowables.



Greetings from **Halliburton**
COMPANY · DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 59, No. 50

CONTENTS December 11, 1961

The week's news

General interest:
Marketing unrest continues, but damage may be less than feared 46
Propane stocks are still too high, but they're finally dropping 49
FTC examiner rules out "good faith" defense in American Oil case 49
Government will take completely new look at oil-imports program 50
Producing states must modernize regulations, Kelly tells IOCC 54
IOCC will collect factual reports on output, reserves 54
California Utilities Commission seeks gas-price controls 58

Drilling-production:
Are miscible floods really worth the cost? 43
Alberta production allowable set at record high 46
Arizona again adopts new conservation rules 48
Canadian natural-gas production continues record-breaking growth 59
Oilfield crews begin drilling toward nuclear blast cavity 62

Pipelining:
New automatic-welding machine handles small-diameter pipe 52
Canada approves Alberta-U. S. condensate line 52
Pipeline briefs 58

Processing:
Military told to revise system of set-aside awards to refiners 52
Air Force adopts anti-icer additive as JP-4 requirement 55
Where southwestern refinery runs stood in October 56
New petroleum-based processes can lower cost of making acetylene ... 60
Cat cracking can economically dispose of surplus resid. 60

Foreign news:
British Petroleum has its first major Libyan discovery 63
Union's new Australian well flows 250 bbl. daily 63
Big jump in volume increases Russian oil export threat 64
Independents win exploration concession in Togo 67

Exploration:
California gas explorers get impressive results 119
Piceance basin may become one of Rockies' biggest gas areas 121
Wildcat tests Washington's Puget basin 128
Deep drilling makes news in Oklahoma's Anadarko basin 135

Regular features

Advertisers 155
Books 105
Calendar 33
Classified advertising 152
Deaths 145
Discoveries 141
Drilling contractors .. 116
Drilling statistics 147
Editorial 41
Equipment men 113
Exploration 119
Foreign news 63
Journally speaking ... 39
New equipment 108
Personals 142
Price statistics 151
Process costimating .. 107
Processing notes 92
Production statistics . 148
Profile 142
Refining statistics ... 149
Selected monthly data 151
Statistical summary .. 146
The Journal said 39
They say 31
Trade literature 112
Watching Washington 51

Technology section on next page →

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Opinion

Bringing order to a disorderly transition 69
Here are recommendations by Alirio A. Parra, chief of the Venezuelan Division of Petroleum Economics, on methods to be devised for allocating production among members of the Organization of Petroleum Exporting Countries.

Technology

Refining-Processing

First Met-X plant is now in operation 74
By D. H. Stormont
First commercial application of a process for removing metal contaminants from cracking catalyst is undergoing its shakedown run at the Philadelphia refinery of Atlantic Refining Co. The installation is expected to save at least $1,000,000 per year.

Epoxy resin—valuable plant-maintenance tool 82
By R. H. Bacon
These useful resins, some of the most versatile of the modern plastics, are extremely good in combating plant corrosion. Epoxy paint has proved more durable than chlorinated-rubber material for protecting equipment and piping in a corrosive area of medium severity.

Processing notes 92
Refiners are using computers in many applications—New route to acetylene—Catalyst activity up in May-July period—Sulfur content in fuel oils drops again—UK will get first polyisobutylene plant.

Carbon dioxide is byproduct of gas processing 100
By John R. McClanahan and Brenton O. Buck
Natural gas containing about 8% CO_2 is feed stock for a Tidewater gasoline plant in California. First step in processing is CO_2 removal by the hot-potassium carbonate process. A relatively pure CO_2 stream is stripped from the absorbing solution and further purified.

Process costimating—105 107
Refinery processing governs cost of construction and operation.

Pipelining

Welding mechanization is progressing 94
By B. V. Elliott, W. B. Handwerk, and H. B. Cary
Fully automatic process for big-inch and semiautomatic process for smaller-diameter pipe, tested under field conditions, show lower cost, greater speed, and better welds than conventional methods.

Production

Aluminum gathering systems prove successful 78
By R. S. Dalrymple
Aluminum piping offers excellent resistance to corrosion from both soil and petroleum products. When protection is needed, the cost is lower than that of competitive materials.

Drilling

New mud cuts drilling costs 87
By J. L. Lummus, J. E. Fox, Jr., and D. B. Anderson
Pan American is using a new polymer mud to keep solids at a low level, thus lengthening bit runs, speeding drilling rate, and cutting costs. The polymer extends the yield of bentonite, but flocculates native drilled solids.

THE OIL AND GAS JOURNAL **Newsletter**

December 11, 1961

Significant this week

Glamor that once surrounded miscible floods is fading.

There was talk of 80 to 90% recovery when scattering of miscible projects got started several years ago. Now data is coming in, and recovery—in most cases—is below expectations.

Consensus: miscible drives have some advantages over water floods but recoveries, at best, aren't likely to go beyond 60 to 65%. High costs are a drawback, and incentive allowables will be needed to spark wider use (p. 43).

Imports-control battle must be fought all over again.

That's inevitable as result of White House statement which calls for petroleum-requirements study and extends current imports program until study is finished.

Don't look for any changes in controls before mid-1962, when study is scheduled for completion.

Many Washington observers regard White House action as sign that oil controls will be involved in forthcoming congressional fight over tariffs and trade policies (p. 50).

Thorny parts have been snipped out of Interstate Oil Compact Commission study on production and reserves.

Special subcommittee on "equality of opportunity to produce" was disbanded at Denver IOCC meeting last week. That takes care of sharpest controversy among member states. Now executive committee will compile "information-only" reports on production and reserves (p. 54).

IOCC delegates heard some blunt talk about need to update conservation and regulatory practices in producing states.

John M. Kelly, assistant secretary of Interior, warned specifically that states must overhaul unitization, pressure-maintenance, and wide-well-spacing rules. Many listeners felt this was an "or-else" rap on the knuckles, although Kelly didn't hint at federal intervention in his speech (p. 54).

In a Journal "Opinion" article, a Venezuelan examines the problem of allocating production among members of Organization of Petroleum Exporting Countries.

Alirio Parra, chief of Venezuelan oil ministry's Division of Petroleum Economics, discussed this topic at Third Arab Oil Congress. Paper he offered there—now presented by Journal in condensed form—is tied to premise that oil should have only one world market price, rather than different prices for dif-

ferent destinations (p. 69).

Other highlights in the news:

Propane stocks are dropping at last, but they're still well above stocks on hand in latter part of 1960 (p. 49).

Determined attempt to control wellhead-gas prices is being made by California's Public Utilities Commission (p. 58).

Expert says acetylene-making costs can be trimmed by new processes which use petroleum feed stocks (p. 60).

Air Force has adopted Phillips Petroleum's antiicing additive for JP-4 fuel (p. 65).

In top foreign news this week:

Official Russian figures, just available, show nation's crude exports shot up 67% in 1960. Total exports—including products—were up 42%.

Thus the Soviet Union's own statistics bear out western fears that free-world markets are being invaded in force.

Statistics also make it clear that Russia's using oil for political purposes. Crude price to free world last year averaged $1.57 bbl.; price to satellites was $3.03 (p. 64).

News in the making

Expect perk-up in Pacific Northwest exploratory interest. It's being generated by such developments as these:

—El Paso Natural Gas has taken big block on Bellingham basin's Squalicum anticline, Whatcom County, Washington.

—Reserve Oil & Gas may commence wildcat drilling in Linn County, Oregon, next spring on 20,000-acre block taken over from Linn County Development. Well there had good oil shows.

—In British Columbia, only 3 miles from Washington line, Richfield Oil has moved in gear for wildcat on its 20,000-acre block in Fraser River Valley. Pure Oil's reportedly linked to venture, first of three projected tests to 8,000 ft. or more.

Look for current shortage of shallow rigs in California to last until first of year and maybe longer.

Main reason: big drilling program Standard of California is staging in low-gravity fields. Company has about 20 strings of tools running in Bakersfield-Taft-Coalinga area.

Contributing to shortage: slight increase in Sacramento Valley gas play; shallow, large-diameter test holes AEC is drilling in neighboring Nevada.

Will atomic power be competing with petroleum in some areas by the latter part of this decade?

Interesting opinions on this cropped up in Japan last week at U. S.-Japanese forum on nuclear power. Robert E. Wilson, former Indiana Standard chairman who's now with Atomic Energy Commission, thinks that by 1968 nuclear-power plants will be

competitive with "fossil fuels" in what he calls high-cost fuel areas of world. Ichiro Ishikawa of Japanese Atomic Power Commission figures that by 1970 the 0.007-to-0.008-cent-per-kilowatt-hour cost of a big oil-powered thermal station in Japan could easily be matched by atomic energy.

Good bet: Socony Mobil's absorption of Republic Natural Gas will go through without a hitch.

Officials of both firms seem confident that final Internal Revenue Service okay on tax aspects of $150-million, ABC-type deal is just around corner. Republic stockholders vote December 28 on proposal to dissolve company and sell all assets.

Deal involves $40 million in cash, rest in reserved payments out of production. Main buyer of payments is reported to be Albantu Oil & Gas, new company formed by key employes of Lehman Corp., New York.

Watch for another IRS ruling on ABC-type sale of Argo Oil to Atlantic Refining for $133 million. Action's imminent.

Atlantic officials predict Argo purchase will be firmed up by end of this month. Terms: $27 million in cash, reserve payments of $106 million. Atlantic would sell production payments to four other firms.

Other deals:

Field of potential buyers of Plymouth Oil has been narrowed to Ohio Oil. Companies say they have started formal talks on merging. Sale price has been reported to be $100 million.

New Hughes Tool subsidiary, Hughes-Hawthorne, will be filling orders for replaceable-blade-type bits for geophysical drilling. Hughes bought assets of Herb J. Hawthorne, Inc., Houston, former manufacturer of the bits.

Dual-purpose will be served by 2,500-bbl. hydrocracking unit which Cities Service will build at Lake Charles, La.

Besides upgrading sour resid into sweet, middle-gravity crude, it will provide valuable experience for similar project on vastly larger scale. This will be plant—probably to start operating in late 1960's—for upgrading Alberta's Athabasca tar-sand oil into salable crude.

Quiet "revolution" is taking place in crude analyses.

Chemical makeup of crudes is being stressed. Refiners need more information on yield and character of aromatic, naphthenic, and other components—and how they fit into downstream-processing plans.

Texas operators are keeping their fingers crossed while awaiting decision on Southeast Quitman allocation case.

Railroad Commission is weighing Shell's bid for new allocation rule for several reservoirs in the East Texas field.

This is one of first small-tract drilling disputes since famed Normanna gas case. Ruling will set oil-field precedent.

Market memo

Dec. 11, 1961

A **1-cent price advance** by refiners on gasoline was taking shape at weekend at several points along the Great Lakes pipeline.

Phillips kicked off the advance in midweek. Jobbers and resellers in Minneapolis, Des Moines, Kansas City, and Tulsa subsequently received notices from other suppliers they were meeting the advance effective Monday.

Whether the increases stick will depend on disappearance of a few small pockets of low-priced gasoline which plagued the Mid-Continent market earlier in the week. Discounts of one-fourth cent off the going 10.50-cent spot price were reported. The increases would restore the spot market to a 11.50-cent level.

Wholesale gasoline markets also remain nominally steady on the Gulf and East Coasts and along the Mississippi River.

Retail gasoline markets, however, remain in an uproar due to pricing battles swirling around introduction of Gulftane and other marketing innovations.

Prices are depressed in nearly every section but marketers especially are watching for moves in New Jersey and Pennsylvania to gage how bloody the pricing battles may be.

In **New Jersey** Gulftane ranges anywhere from 28.9, or 1 cent below the major brand fair trade price for regular, to 25.9, the lowest private brand price. No major marketers have moved to meet Gulftane. In **Pennsylvania,** Gulftane ranges from 24.9 to 26.9 retail, and only one major has responded.

Comment from one marketer on the inaction: "Pennsylvania and New Jersey are very significant markets. We've been through hell in both of them before and nobody is anxious to return to those days."

The situation emphasizes the air of caution with which marketers are now approaching the new pricing battles (see p. 46).

Distillate markets are beginning to hurt from lack of cold weather.

Off-season discounts have been lifted—2 months late—in Pennsylvania and Delaware but still remain in the big New York Harbor market. Distributors also are feeling a storage pinch to take care of supplies for their contract buyers. A real siege of winter weather is needed to lift further discounts and forestall any price-cutting tendencies.

Same general inactivity marks distillates on Gulf Coast, the river, and Mid-Continent.

Marketing notes: NOJC officials are protesting Mobil move to cut jobbers' guaranteed margins from 2.5 to 2 cents in North Carolina . . . **Crude market** must have a firm base if Gulf can easily resell 2.5 million barrels of oil in November and December. It didn't need the oil because of strike at Port Arthur . . . **Refinery runs** hit 8.5-million bbl. daily last week, up 215,000 bbl. daily. More than half the gain was on the East and Gulf Coasts. Gasoline stocks gained over week before, and distillates eased off. The inventory position would have been worse except demand shot up past 11-million bbl. daily first time this season . . . **Continental** is putting so much importance on marketing these days that marketing executives now report directly to the president.

LONE STAR

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LONE STAR

PROTECTION IN DEPTH

How it helps cut compensation costs

Making hazardous work less hazardous

Making up a joint is rugged work. Handling the slips and drill pipe, throwing chain and operating the tongs are all hazardous functions on the derrick floor. Poor housekeeping and lax maintenance needlessly add to the risks. By checking your rig carefully and pointing out these hazards, a Liberty Mutual loss prevention engineer can help you improve your odds against worker injury.

But safety engineering is just the beginning of Liberty's protection in depth. This broad concept in loss control also includes a full-time auditing staff, two rehabilitation centers, a special paraplegic ward, and the diagnostic services of leading orthopedic specialists in 78 cities. At Liberty's research center, technicians study ways to help make machines, methods, and environments safer.

These and other services of Liberty's protection in depth helped save many millions of dollars for Liberty Mutual workmen's compensation policyholders last year. To learn more about Liberty's protection in depth (and how it can save *you* money), just call the nearest Liberty Mutual office.

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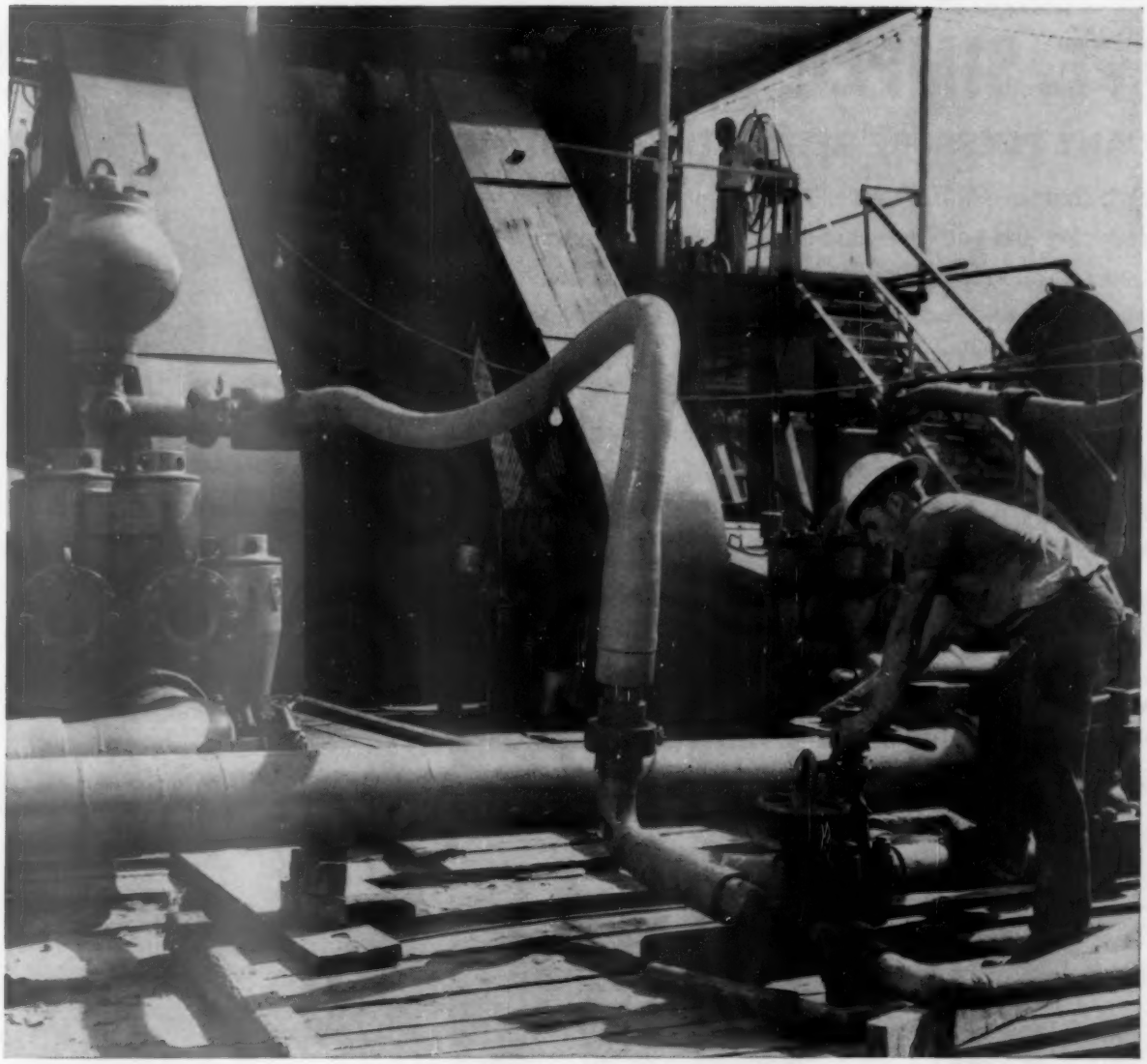

Pump wants to jitterbug, but hose won't dance

THAT hose was specially developed by B.F.Goodrich to keep the destructive vibrations of the mud pump from shaking off connections. It's so flexible that it absorbs the pump's vibrations, can't be jarred loose. And it's so tough it lasts for years under the most severe operating conditions.

Spiral-wrapped cable wires make B.F.Goodrich vibrator hose resistant to bursts. Hose ends are reinforced to protect against bending stress at the couplings.

It has an abrasion-resisting, oil-resisting tube that will not swell, rot or wear away. Tube is smooth so mud flows through at high speed.

The thick rubber cover on the hose is extra tough—resists gouges, scrapes, tears. Hose can be loaded onto trucks, moved from job to job, dragged into position without fear of damage. Sun, wind and rain won't weaken it either.

When B.F.Goodrich vibrator hose offers all this, why settle for anything less? You'll find it at leading supply houses in the oil field, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Shreveport, Hobbs, Oklahoma City, Tulsa, Corpus Christi, Dallas, Houston and Odessa. *B.F.Goodrich Industrial Products Co., Dept. M-193, Akron 18, O.*

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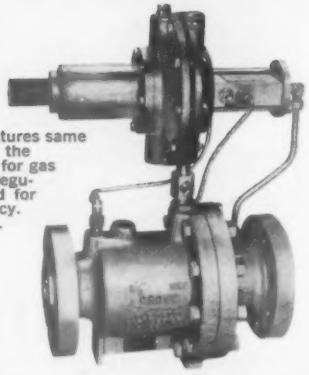
Model 888, self-operated, gas dome-loaded. Setting is fast, easy, without springs or pilots. Recommended for natural gas, air and liquids. Bulletin #888-D.

GAS PRESSURE REDUCING FLEXFLOS

Model 80-820 where extreme accuracy is critical. Sensitive, spring loaded model 820 Grove pilot is a diaphragm controlled, three-way throttling valve. Seven adjustable spring ranges from 2 psi to 1200 psi. Send for Bulletin #813-B.



Model 80-830 features same type of pilot as the 80-820, adapted for gas back pressure regulation. Designed for extreme accuracy. Bulletin #813-B.

Grove Sets Regulator Standards for Others to follow

7078

Model 80-836A, designed for "pounds to ounces" pressure reduction. For inlet pressures to 100 psi and adjustable control ranges from 2 ounces to 20 psi. Bulletin 813-B.

Model 80-833, for low pressure services. 833 pilot is available with three adjustable spring ranges: 10-30 psi, 15-75 psi and 25-150 psi. Bulletin #813-B.

Better Production Tools Through Research

OTIS Equipment NEWS

Volume III, Number 5 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Self-Retracting Hold-Down Uses Reservoir and/or Treating Pressure To Help Anchor New Hookwall Packer

By-Pass Ports Are Located Above Hold-Down to Minimize Equalization Problem

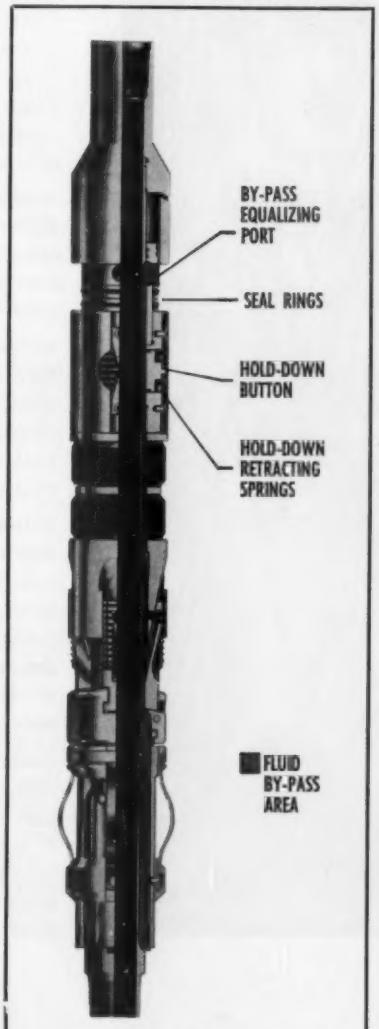
DALLAS — How better can you anchor a packer in a well than to utilize the pressure that is trying to force it up the hole to help lock it in position? That's the design principle employed by the hydraulic hold-down of the new Type RSMA Otis Packer.

Type RSMA Otis Packers are a series of retrievable, tubing set packers rated to 7,500 or 10,000 p.s.i. at 300° F. They combine several new and unique features with many of the time-tested advantages of other Otis Packers to provide the industry a more reliable "hookwall" packer. The tool has a standard J-Latch arrangement with provisions to automatically relock the packer in the running position while in the hole for resetting.

Design Principles of Hydraulic Hold-Down

The Type RSMA Otis Packer uses a new and somewhat unique hold-down mechanism. The principles employed in the design of this mechanism are as follows: In the running position the hold-down buttons located just above the packer's resilient elements are held retracted by individual retracting springs and isolated from the fluid pressure in the tubing. Once the packer is set, the hold-down buttons are exposed to pressure below the packer through an equalizing bypass area between the packer's inner mandrel and outer body which is sealed at the top. This permits the pressure from below the packer, which is trying to force it up the hole, to expand the hold-down buttons. The greater the pressure from below the packer, the greater the force exerted on the hold-down buttons. The combined casing contact area of the hydraulic hold-down buttons on the 5½" model totals 16 square inches, an area considerably greater than available with a tubing-type hold-down.

Picking up on the tubing to release the packer when retrieving opens the by-pass area to permit equalization across the packer. Once pressure has been equalized, the leaf-type retracting springs on each of the hold-down buttons serve to retract the hold-down.

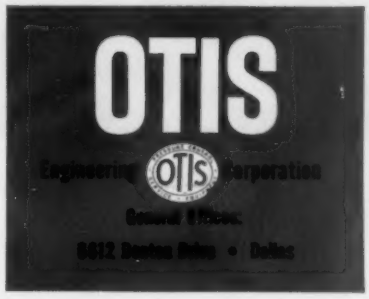


TYPE RSMA OTIS PACKER
©O.E.C. 1961

Advantages of RSMA Design Principles

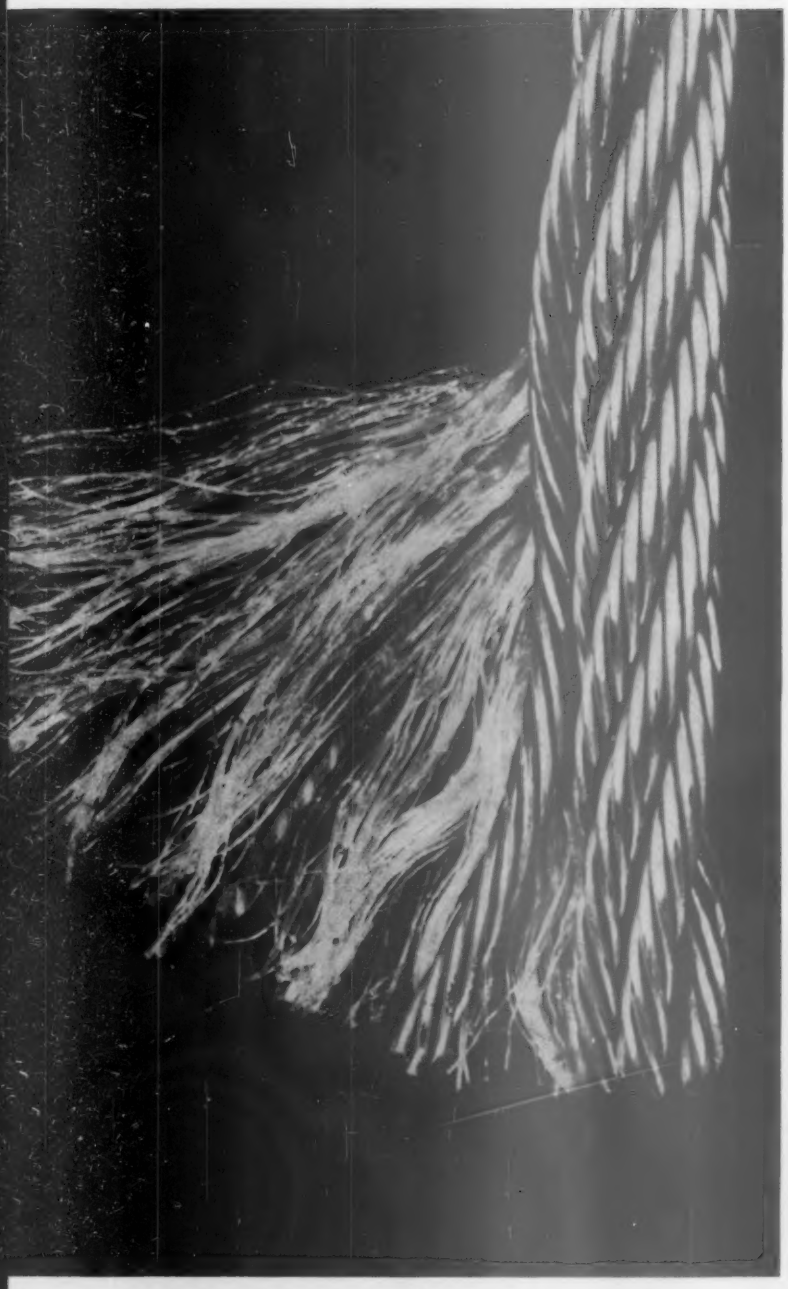
The Type RSMA Otis Packer is designed to be run in the well on tubing and set by one-third turn of the tubing at the packer, setting down tubing weight to expand the resilient elements. It has a full-opening bore to pass standard size wire line tools, perforating guns, pressure bombs, etc. The tool is available with a choice of resilient packer elements. The 5½-inch model is designed to set in a wider range of casing weights (13 to 20 lbs.), without modification, than any other retrievable tubing set packer of this type and yet the resilient packer elements have a smaller outside diameter than the O.D. of the smallest metal part of the packer's body. This feature is designed to protect the resilient elements from junk, etc. when running, retrieving and resetting the packer.

The Type RSMA Otis Packer is another example of the knowledge and ingenuity of the packer design section of the Otis Engineering Department. Although advanced in concept, this new tool utilizes operating principles tested by years of performance in the field. When you combine the advantages of new Otis production tools like the Type RSMA with the experience and knowledge of your local Otis Packer Specialist, you will find you are getting the finest in service and performance. For more information on the Type RSMA Otis Packer or for information on other Otis field-proven packers, call the Otis office nearest you or write Otis, Dept. E-5, P. O. Box 35206, Dallas 35, Texas. You'll find experienced service specialists ready to help you . . anxious to serve you . . with the widest variety of field-tested production tools available today.



The "OILWELL" string...

PRODUCTS
SERVICES
STORES



PETROFIBER

the only wire line core that is 100% resistant to all hole fluids

The search has ended for a wire line core that eliminates washout and early failure. PETROFIBER is the answer. Developed and proven by U. S. Steel's American Steel and Wire Division, PETROFIBER is used in USS Tiger Brand Wire Lines for drilling, swabbing, coring, etc. and delivers these remarkable advantages:

100% resistant to all hole fluids. PETROFIBER is completely impervious to acids, caustics and other corrosive agents such as sour crude, salt water and hydrogen sulphide gas. No more core washout or erosion.

A more stable line. PETROFIBER cores stop core flow and migration. They give such excellent strand support, and maintain uniform line diameter under all conditions, that they bear no resemblance to any solid plastic core line you've ever used.

Withstands temperatures from −80°F to 300°F. PETROFIBER cores withstand continuous operation at higher well temperatures than ever before. Lower possibility of flattening or core squash-out at overheated drum flanges. And because they're even tough at *minus* 80°F, you can use them to equip rigs in the Arctic.

Ends storage problem. PETROFIBER cores don't absorb hole fluids or chemicals, so you can store without rot or progressive aging.

USS Tiger Brand Wire Lines with PETROFIBER Cores are made in standard constructions, 6 x 7 and 6 x 19, in all regular sizes. Buy it through your "Oilwell" store.

Service with a smile

Who wouldn't smile under these conditions? In the picture, AS&W Service Representative Bill Campbell is checking the condition of a USS Tiger Brand Wire Line with PETROFIBER Core after a year of work swabbing deep wells. Its biggest job was a 17,300-foot well in Pecos County, Texas, where it swabbed continuously for four weeks. During that time it handled 121,000 gallons of 15% hydrochloric acid, preheated to 180°F, pumped into the well and swabbed back immediately (bottom hole temp. was 280°F), and 145,000 gallons of gelled water and frac sand. Just about the most corrosive conditions a swabbing line would ever have to handle. The payoff: the PETROFIBER core showed no sign of acid attack or deterioration of its strand supporting ability. So Bill Campbell didn't have a problem, but he is one of 25 American Steel and Wire Service Reps who are on hand to help you with any wire rope problems you have. When you buy Tiger Brand Wire Rope through "Oilwell", you can be sure our product is backed with the best service you can find.

Free advice

Free advice is great when you ask for it. A lot of people do in "Oilwell" stores. They have operating problems that they know the "Oilwell" man can help them with. He has years of experience, knows all the latest and most up-to-date developments in drilling and producing methods. And he sells the best equipment you can buy anywhere. There's an "Oilwell" store near you—drop in even if you're only looking for free advice.

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USS

Oil Well Supply Division of United States Steel

Executive and Export Offices: Dallas, Texas

GET DEPENDABLE DOWNHOLE READINGS... *without pulling the pump*

A major oil company had a reservoir engineering problem. Downhole temperature and pressure readings of a pumping lease were needed to help determine required production stimulation and/or pumping rate modifications to maintain the best production rate from the field.

Facing the task of pulling the pump from each well to obtain this data, the producer asked Halliburton to design a Measuring Reel with which they could run bottom hole instruments in the annular space between tubing and casing without fouling the instruments down hole.

The answer was the Halliburton Fluid-Drive Reel Measuring Assembly, with a built-in torque cushion. This gives advance indication of hanging the line and reduces the hazard of pulling it in two when the tool or instrument wraps around the tubing or hangs up when coming out of the cased well or open hole.

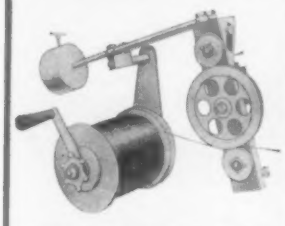
HERE'S HOW IT WORKS

The Hydraulic Fluid-Drive Reel Assembly is driven by a hydraulic motor, powered from an engine-driven pump. A fluid by-pass, running parallel to the hydraulic system, incorporates a needle valve which may be preset to a specific shut-down pressure. If excessive loading of the wire line occurs, such as when the line wraps around tubing, the needle valve causes the pump to stall out and act as a hydraulic brake on the driving motor. This unique system gives a more accurate control of the speed and line pull of the measuring line reel going in and coming out of the well. Design flexibility of the Fluid-Drive Measuring Assembly provides for a completely packaged unit powered by gas/gasoline or diesel engines, as well as electric or air motors. Standard reel capacities include 24,000′ of .066″; 20,000′ of .072″; 17,000′ of .082″; 14,000′ of .092″ regular measuring line; or 4,900′ of 9/64″ cable or well shooter line.

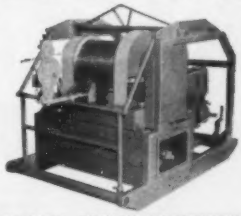
BETTER MEASURING EQUIPMENT
for demanding jobs, such as . . .

- Measuring Top of Cement
- Cable Tool Depth Measure
- Hole Deviation Tests During Drilling
- Reservoir Engineering
- Swabbing and Sand Washing
- Pulling Chokes and Gas Lift Valves
- Dual Zone Rework

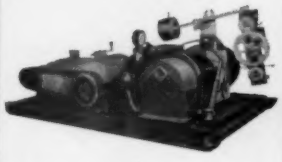
HALLIBURTON MEASURING ASSEMBLIES



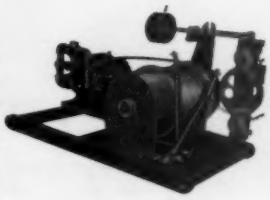
STANDARD MEASURING DEVICE for manual or cathead operation. Available in model shown, or in Heavy Duty type with hand brake.



ENGINE DRIVEN MEASURING ASSEMBLIES are available with diesel and gas/gasoline power in several sizes for light to severe wire line operation.



ELECTRIC MOTOR DRIVEN MEASURING ASSEMBLIES for use where electric power is the most practical application.



AIR MOTOR DRIVEN MEASURING ASSEMBLIES for pneumatic operation off rig air supply.

A FULL LINE OF ACCESSORIES

UNMATCHED MOBILITY can be provided any Halliburton Measuring Assembly with this light, two wheel, metal covered trailer.

LATCH TYPE HAY PULLEY AND LINE WIPER efficiently guides the line into the hole, automatically wiping it free of foreign particles which might damage the line or stuffing box.

STUFFING BOX AND STAFF ASSEMBLY available in models for working pressure of up to 5,000 psi and 15,000 psi.

MEASURING LINES are available in lengths up to 25,000′ in economical Regular Type Black, Galvanized Steel, Nickelply and Stainless Steel. Standard diameters are .066″, .072″, .082″, and .092″.

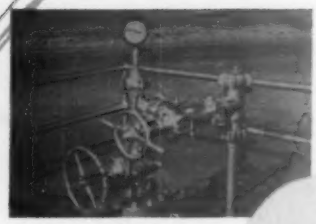
REPAIR PARTS AND SERVICE are immediately available through all Halliburton Field Locations.

Contact your Halliburton Representative for full details on a Halliburton Measuring Assembly. It can be tailored to your exact needs.

MEASURING EQUIPMENT

275 Service Centers . . . just minutes away from your well!

Halliburton
COMPANY • DUNCAN, OKLAHOMA



Christmas Tree Wings

Pressurematic High/Low Safety Valves

Production Manifolds

Waterflood Manifolds

Heaters

BUSIEST VALVE IN THE OIL FIELD

UNIBOLT

ADJUSTABLE VALVE

This valve does so many jobs . . . so well . . . so economically. An Oklahoma waterflood Operator writes that it has practically eliminated valve failures on a manifold where conventional valves were being replaced every few months.

An Operator in Southeast Texas had a severe corrosion problem with carbon steel valves on gas-distillate wells. Replacements were being made every six to eight weeks. UNIBOLT Adjustable Valves with special analysis stainless steel stems and seats have been in continuous service on the same wells since 1946, and are still in excellent condition! Many Operators have standardized on UNIBOLT Adjustable Valves for practically all production services because they can be converted to either positive chokes or to automatic high/low valves by substituting interchangeable parts. Thus, inventories of these three items can be kept at a minimum.

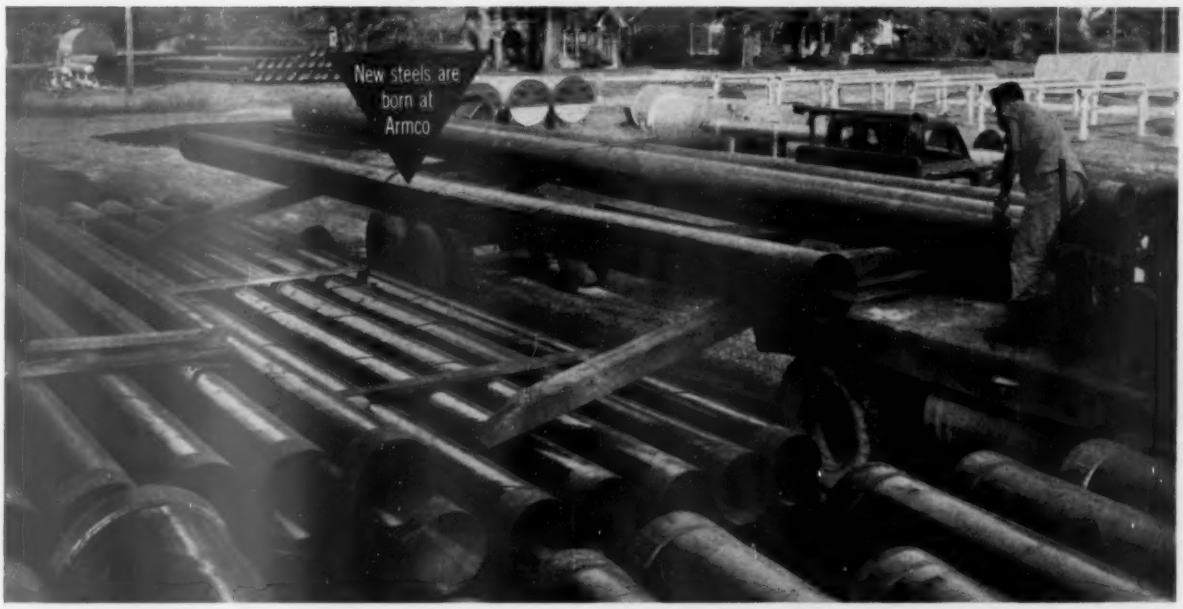
UNIBOLT Adjustable Valves have numerous distinctive features that make them ideal for general oilfield service. For the complete story, call any UNIBOLT representative or write:

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

ARMCO CASING
Gets to You Fast, Goes in Fast



Strong
Durable
Economical

Steel

Rugged, lightweight Armco Casing is delivered *where* and *when* you need it. There are no delays to hold you up. Distributed by National Tank Company from 26 stocking points located throughout the oil country, Armco Casing is available in sizes from 6 to 24 inches.

In addition to quick delivery, Armco Casing can save you money by reducing running time. Supplied in exact 40- or 50-foot lengths, there are fewer joints in the string. Faster running is the result. Also, uniform lengths help you quickly determine the footage in the hole or in the stockpile at any time.

For information about how Armco Casing can serve *you,* mail the handy coupon.

Armco Drainage & Metal Products, Inc.
6441 Curtis Street, Middletown, Ohio

Send me more information about Armco Casing

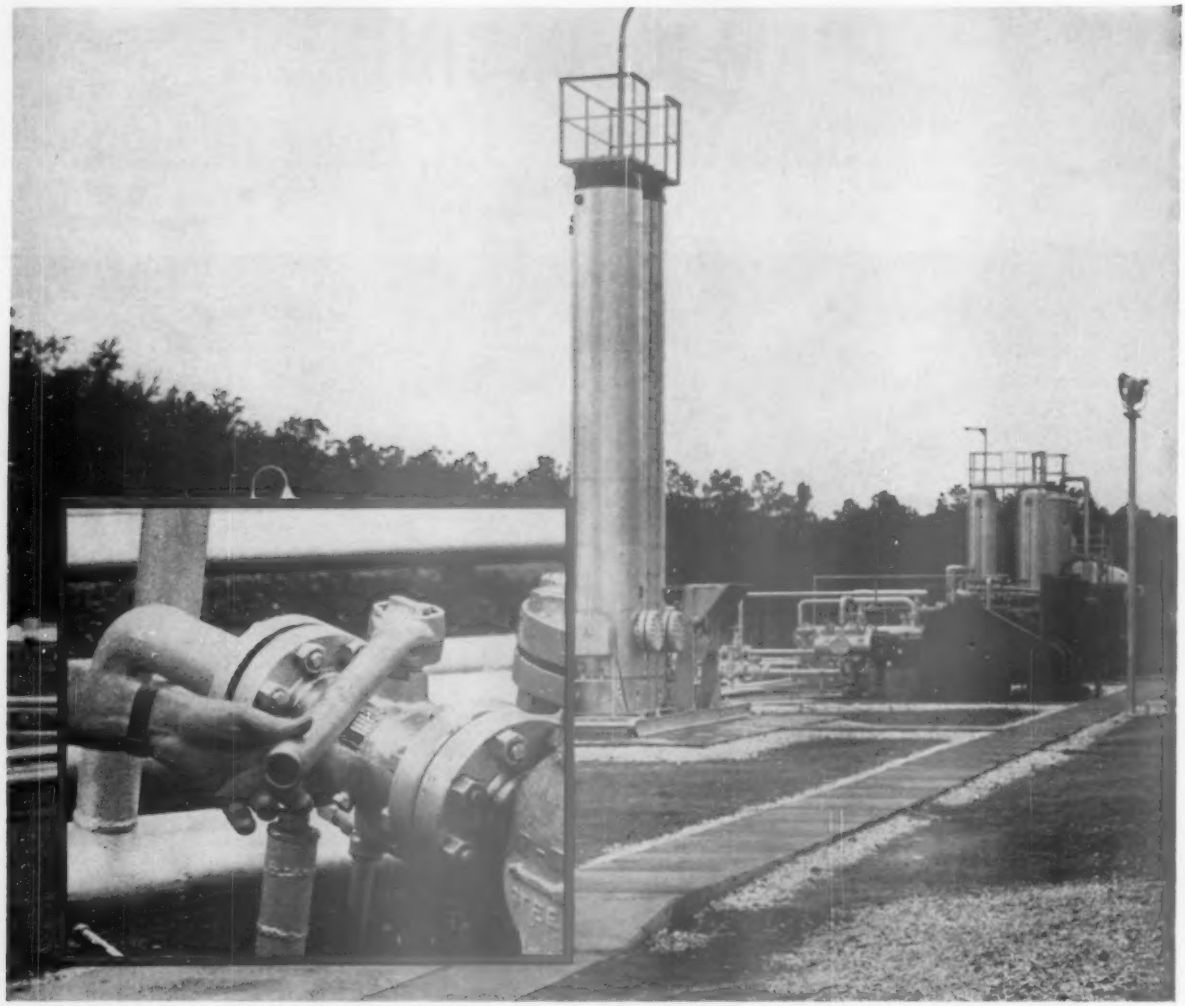
NAME_____

ADDRESS_____

CITY_____

STATE_____

ARMCO Drainage & Metal Products



ON STREAM

with Cameron Ball Valves

You can relax when "on stream" with Cameron Ball Valves. You are "on stream" without valve operating problems because rotating valve seats prevent wire-drawing and seat leakage, – and low friction Teflon assures opening and closing with ease.

You are "on stream" without interruption from valve trouble for Cameron Ball Valves require no maintenance. Simple in design, they have no joints to leak and no stuffing boxes to repack. "Sealed for life" design assures no repairs for the entire life of the valves so you have no problem of parts inventory.

For continuous trouble-free operation go "on stream" with Cameron Ball Valves. They are made in 150 lb to 1500 lb ASA ratings in sizes 2″ to 42″ and with materials and end preparations to suit your requirements.

Cameron

CAMERON IRON WORKS, INC.
P. O. BOX 1212 HOUSTON, TEXAS

Because it can actually repay its cost . . .

Davison Silica Gel for natural gas drying has more than tripled in use in only 6 years!

Last year over three times as much Davison Silica Gel was installed in natural gas drying operations as was sold in 1955! 320% increase . . . in only 6 years. The growth hasn't stopped yet. More and more natural gas processors are switching to Davison Silica Gel.

Why? Davison Silica Gel can actually repay your cost of natural gas drying with recovery of valuable hydrocarbons. The large surface area and pore volume of Silica Gel attain recovery efficiencies up to 95%, producing as much as 3 gallons of usable pentane-plus per 100 pounds of Davison Silica Gel.

Regeneration is easy and almost total. Some installations are still on stream without change after seven years, others three or more. For natural gas drying, hydrocarbon recovery, drying of cracked refinery gases, ethylene and propylene, Davison Silica Gel's high purity and greater capacity make it the ideal desiccant. For complete information, write today:

GRACE

DAVISON CHEMICAL

Industrial Chemicals Dept. 3112

Baltimore 3, Maryland

This is one of many LIGHTNIN Mixers blending fuel oils and gasoline at the Cities Service Trafalgar Refinery near Toronto, Canada.

How to turn over 90,000 barrels —without spilling a cupful

At the flip of a switch, this 25-hp LIGHTNIN Mixer starts a slow but powerful ripple of gasoline surging across the tank's bottom and up the opposite side.

Not long afterward, the entire 90,000 barrels of product in the tank are moving in a steady blending pattern. From then on, every gallon of liquid drawn from the tank will test the same as every other gallon.

The maintenance man doesn't need to worry about packing or tightening a stuffing box on this mixer. There isn't any stuffing box. Instead, a rotary mechanical seal that he never has to adjust holds the product where it belongs, without a leak.

If necessary, the seal can be replaced *in minutes*—without dismantling or removing the mixer, even under a full head of liquid in the tank.

This seal, optional on all LIGHTNIN Side Entering Mixers, is helping refiners everywhere reduce maintenance costs and shutdown time. It's only one example of the advanced thinking and up-to-date engineering you get when you choose LIGHTNIN Mixers for your big tanks.

To learn more about this cost-cutting kind of mixing, call in the LIGHTNIN Mixer man in your area. He's listed in Refinery Catalog and in the yellow pages of your telephone book. Or write directly to us.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-n Mt. Read Blvd., Rochester 3, N. Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

In Europe: Lightnin Mixers, Ltd., Poynton, Cheshire, England

First basic improvement in multi-use grease...

NEBULA® EP-1

Now you can buy a *multi-use* grease that generally outperforms most *special purpose* greases! NEBULA EP-1 is especially developed for tough jobs — where heat, water, oxidation or heavy loads have previously limited the use of a multi-use grease. The unique formula of NEBULA EP-1 gives superior equipment protection . . . with all the economies you expect from multi-use grease. Order NEBULA EP-1 from your nearest Humble Bulk Plant, or call Humble Oil & Refining Company, Houston, Texas.

NEBULA EP-1 offers these economies:

- *One* grease bought in quantity — tubes, pails or drums
- Reduced inventory and handling
- A multi-use grease always handy

HUMBLE OIL & REFINING COMPANY

America's Leading ENergy COmpany

ENCO PRODUCTS

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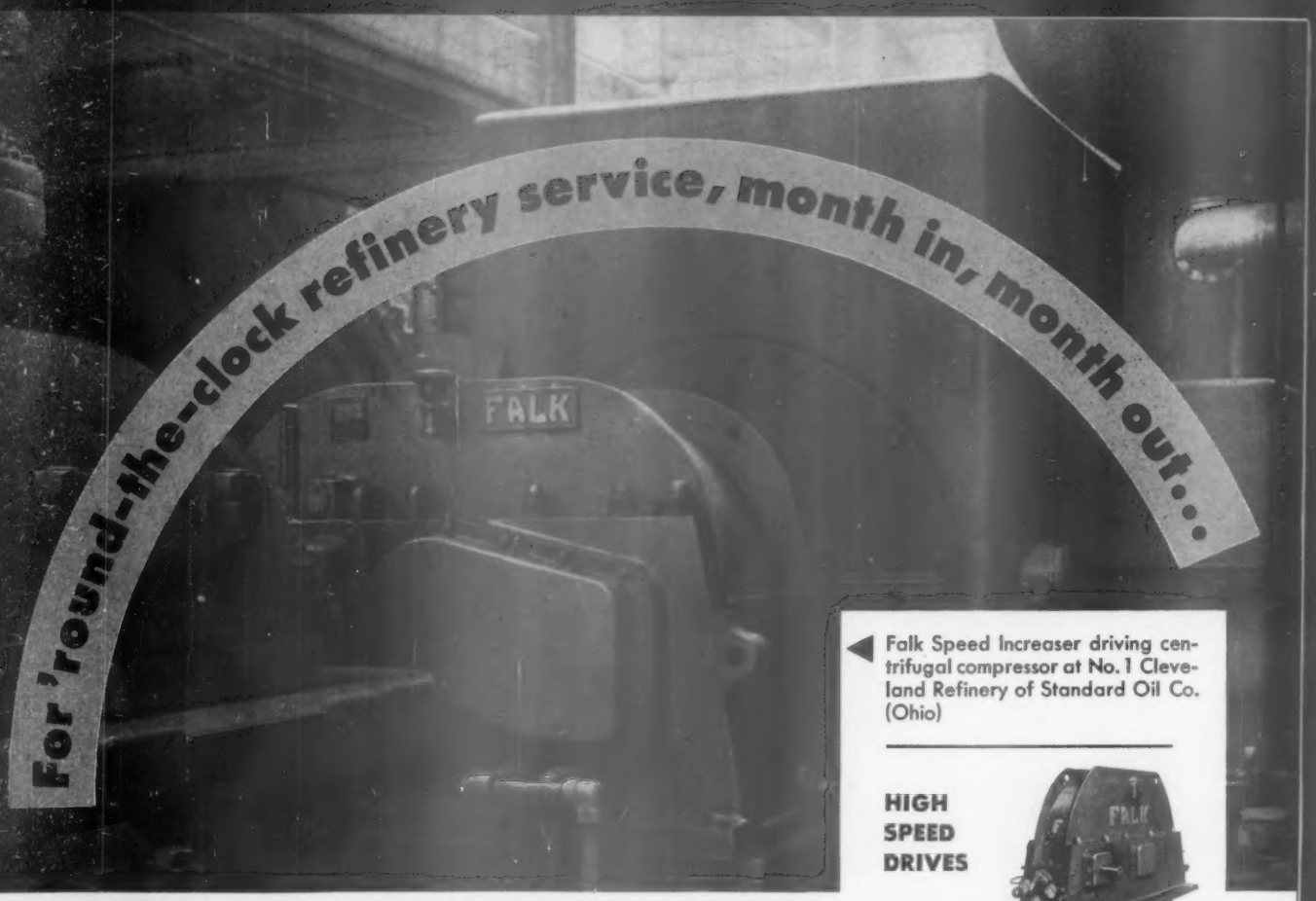


◀ Falk Speed Increaser driving centrifugal compressor at No. 1 Cleveland Refinery of Standard Oil Co. (Ohio)

FALK offers a complete line of standard high speed and semi-high speed drives

type P Ratios—from 2.5:1 to 12.0:1.
Horsepower—up to 2000 hp per 1000 rpm of high speed shaft.
Maximum speed of high speed shaft: 10,000 rpm.

type Q Ratios—from 1.15:1 to 9.5:1.
Horsepower—up to 1800 hp per 1000 rpm of high speed shaft.
Maximum speed of high speed shaft: 10,000 rpm.

type H Ratios—from 2.22:1 to 9.89:1.
Horsepower: up to 1100 hp.
Maximum speed of high speed shaft: up to 3600 rpm.

type S Ratios—from 1.49:1 to 25.4:1.
Horsepower—up to 224 hp.
Maximum speed of high speed shaft: 4500 rpm.

SPECIAL DRIVES...to any required speed and horsepower.

• • • • •

Designed and produced by the Falk engineers who pioneered the ultra-high speed gear units for aviation turbo engine test facilities, Falk standard high speed drives are widely used in refineries throughout the country. Our technicians will be glad to work with your engineers or with your equipment suppliers to select and produce drives precisely suited to your operation.

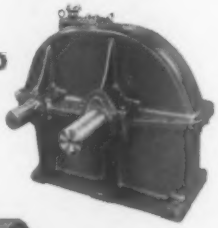
FALK is a Registered Trade Mark.

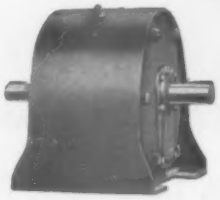
HIGH SPEED DRIVES

type P

type Q

SEMI HIGH SPEED DRIVES





type H

type S

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives in Most Principal Cities

FALK

a good name in industry

CANADA'S

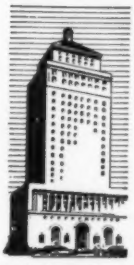
OIL & GAS

BANK

PROVIDES THE INDUSTRY WITH SPECIALIZED SERVICE

Banking men *and* oil men — the men who staff our Oil & Gas Department are by experience and training exceptionally well qualified to serve Canada's petroleum industry with every needed banking facility.

Among the most valuable services provided by this group of "banking-petroleum" experts are the periodic special bulletins covering industry activity. Up-to-date information on regulations, tariffs, financing, basic statistics and many another subject pertinent to the industry will be found in this series of bulletins. All are frequently revised to keep pace with developments.



For copies of current bulletins, write to The Royal Bank of Canada, Oil and Gas Department, 409 Eighth Avenue West, Calgary, Alberta, or get in touch with any of the Representatives listed below.

We do not provide information on oil securities.

THE ROYAL BANK OF CANADA

Head Office: Montreal • New York Agency: 68 William Street • Dallas Representative: T. C. Marshall, 300 N. Ervay Street

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Over 1,000 branches in Canada, the Caribbean and South America

Moisture removal for third magnaflux test of every length of E.W. line pipe

TEST

quality control tests make sure Youngstown line pipe won't fail in the field

Take the pipe and check the weld. Then crush an end. Burst a length. Pressure-test it hydrostatically. From ore to steel to final stenciled product, separate mechanical and visual inspections make sure Youngstown line pipe won't fail in the field.

Get Youngstown Electric Weld line pipe in sizes 6⅝" to 22" O.D. Get it in time and money-saving long lengths to 55 feet. Order Youngstown Seamless line pipe in sizes 2⅜" to 14" O.D., Continuous Weld line pipe in sizes ⅛" nominal to 4½" O.D. Get it fast, when and where you want it, through Youngstown District Offices, through any one of 900 independent pipe distributors.

Count on Youngstown for line pipe you can depend on. For gas and oil gathering, transmission and distribution lines. For product lines from petrochemical plants and refineries. For quality pipe wherever line pipe is needed. You get value and performance when you buy line pipe from Youngstown, world's second largest pipe producer.

Youngstown – growing force in steel

For complete information about Youngstown line pipe, write Dept. 18-B.
The Youngstown Sheet and Tube Company, Youngstown, Ohio.

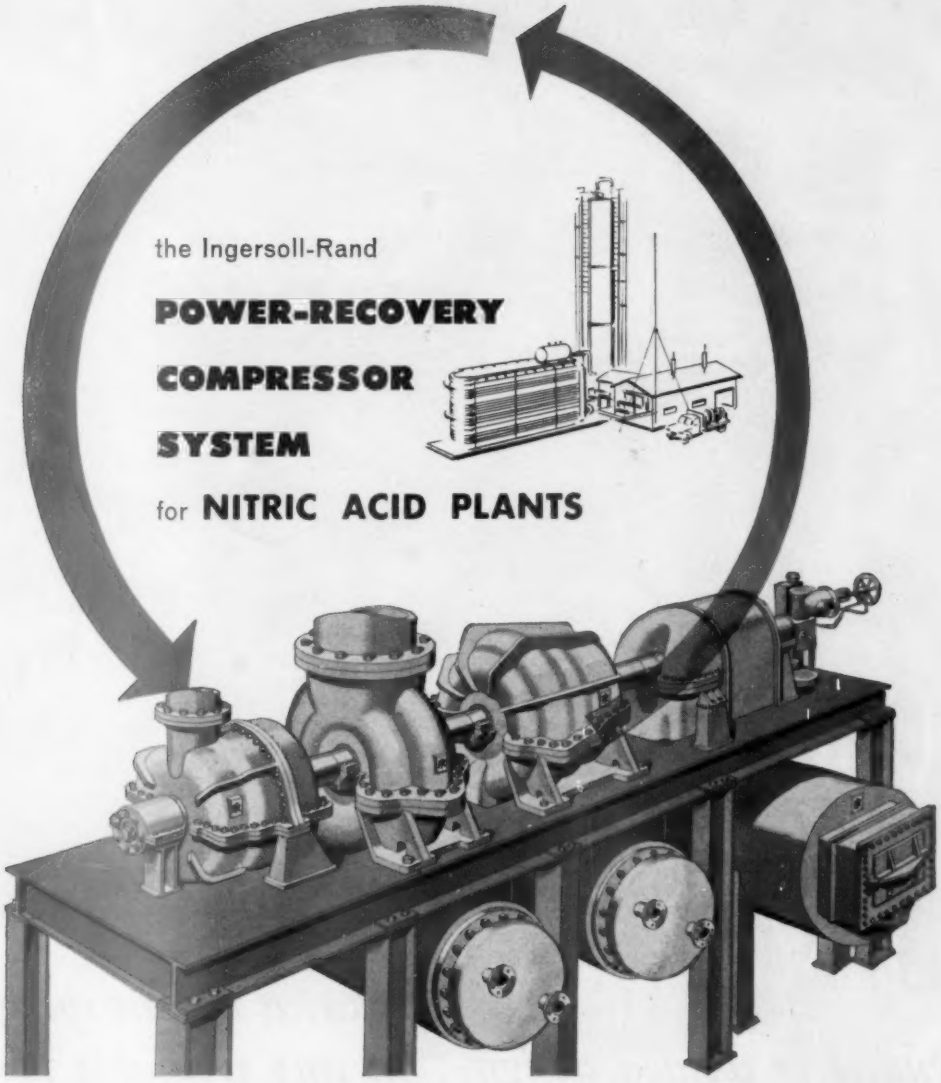
SPECTATORS AT DEDICATION OF PORT BREGA TERMINAL, LIBYA, OCTOBER 1961

"Libyans – at all levels and in all parts of the country – have shown their willingness to join in the work of making their nation a significant oil producer. We in Jersey have been fortunate to be associated with such people in the big job of bringing Libyan oil to world markets."

–M. J. Rathbone, President

Standard Oil Company (New Jersey)

(WHOSE PRINCIPAL U. S. OPERATING AFFILIATE IS HUMBLE OIL & REFINING COMPANY)



Designed for maximum performance and dependability with modern high-temperature cycles

Operating entirely from by-product energy available in the nitric acid plant, the new Ingersoll-Rand Power-Recovery Compressor System combines the latest advances in both compressor and expander design.

Developed after years of research, the completely integrated self-powered system includes an I-R inter-cooled CVM air compressor driven by a hot-gas-expander turbine. An auxiliary steam turbine is used for start-up and contributes the small amount of additional power required for normal operation.

The expander turbine, driven by hot waste gases from the acid plant, is designed for operation at gas temperatures of 1100F or higher, taking full advantage of the higher efficiencies obtainable with high-temperature cycles.

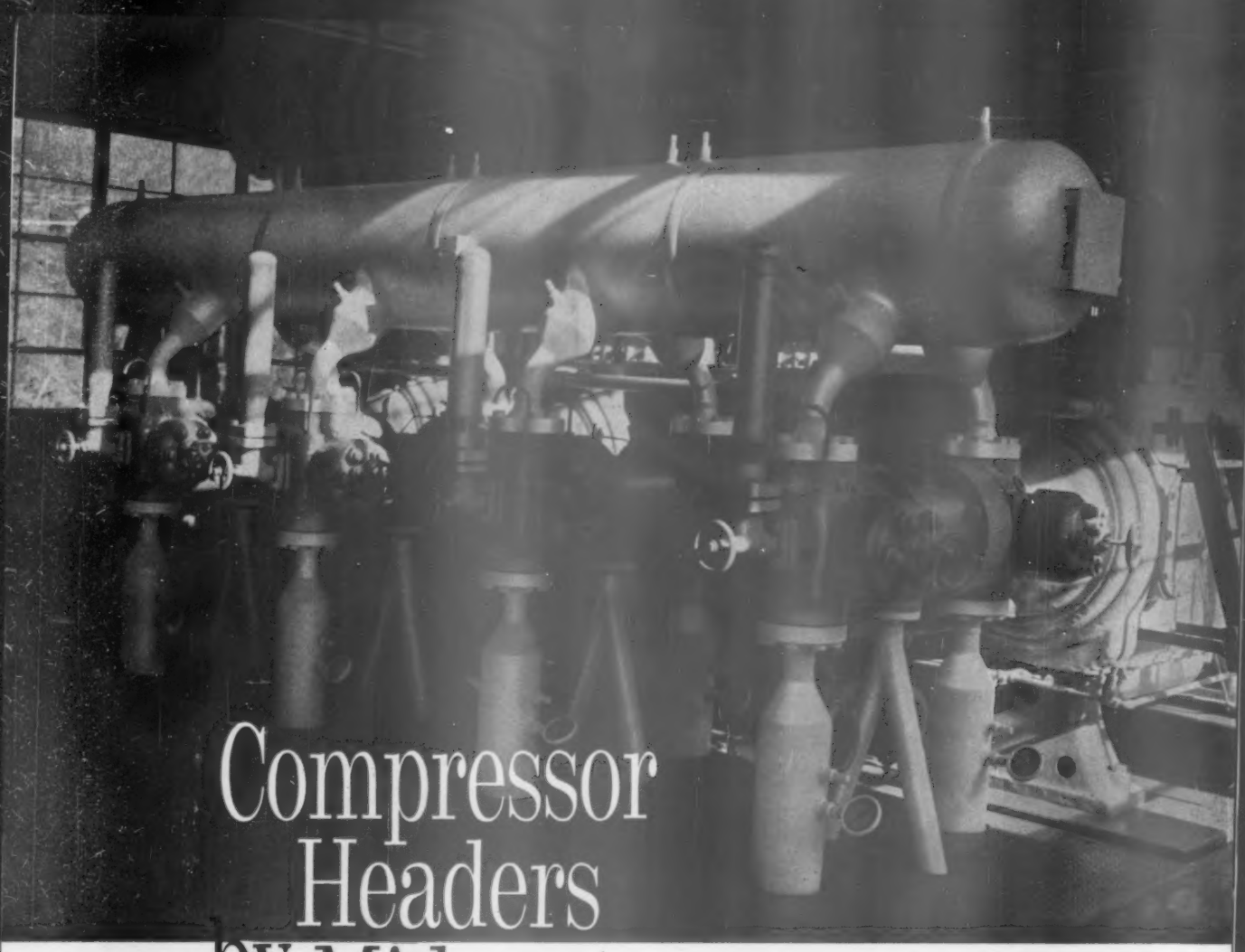
The CVM centrifugal compressor with integral inter-stage coolers provides the optimum combination of compressor efficiency and air heating requirements. And the steam turbine provides low-cost auxiliary power from by-product steam from the waste-heat boiler. Any other type of auxiliary driver can be supplied if desired.

Ask your Ingersoll-Rand engineer for complete information, or send for Bulletin 8280

Ingersoll-Rand

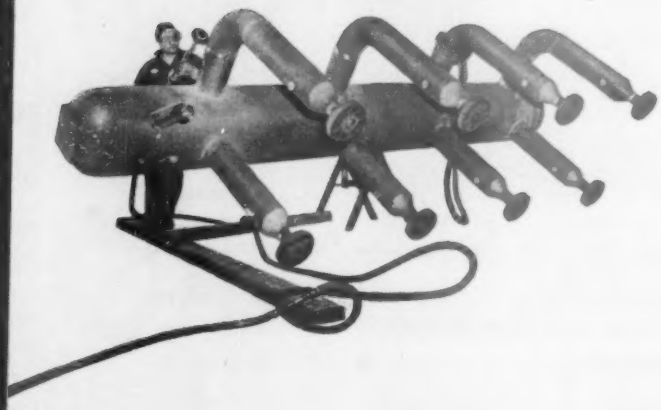
309A12 11 Broadway, New York 4, N.Y.

THE WORLD'S MOST COMPREHENSIVE COMPRESSOR EXPERIENCE



Compressor Headers by Midwest

Fabricated to your specification ...extruded or welded design...in any weldable metal



These compressor headers, fabricated for United Fuel Gas Company's compressor station at Coco, W. Va., are typical of the precision and quality of Midwest workmanship.

Upper header, formed of 24" O. D. x 1¾" thick rolled and welded Grade B carbon steel plate, has eight 8" extruded outlets reducing to 3" 1500 lb. flanged ends, and one 8" and one 3" full-size flanged outlets.

Lower header, of same diameter and wall thickness, contains eight 8" extruded outlets reducing to 3" 1500 lb. flanged ends, one 4" outlet, plus a 24" x 6" extruded cap.

This station, operating at 2000 lb. pressure, comprises five 880 HP and one 1100 HP gas engine compressors.

Midwest can produce headers to your exact specifications, in either welded or extruded type, and will gladly offer assistance on manufacturing and metallurgical problems.

New 36-page brochure, PIPELINE FITTINGS, describes Midwest fittings and fabricated piping for pipelines. FREE!

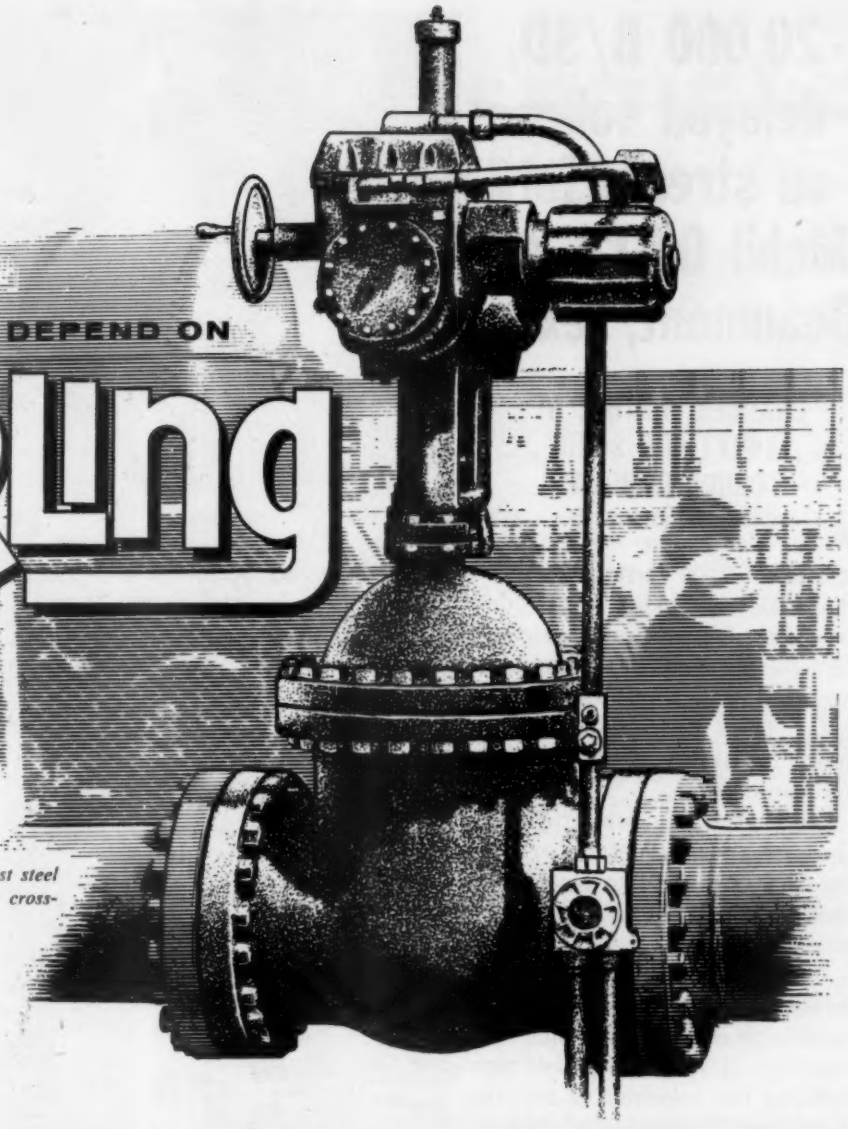
MIDWEST PIPING A Division of Crane Co.

1450 South Second St., St. Louis 4, Mo.

6119

YOU CAN DEPEND ON

Darling



Motor-operated, 18" Darling cast steel gate valve installed on a major cross-country products line.

Darling pipeline gate valves have established an impressive record in reducing down-time and maintenance costs to a minimum.

The fully revolving double disc parallel seat and wedge principle makes Darling cast steel gate valves outstanding in pipeline service. This simple, yet unique, design minimizes friction, avoids concentrations of wear and compensates for valve seat distortion. *You can depend on Darling* gate valves to close tight even under severe line stresses and extreme temperature changes. They open fully to permit free passage of line scrapers.

Write for descriptive bulletin or outline your service needs and ask for our recommendations. No obligation, of course.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario, Canada
Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France

GATE • BUTTERFLY • CHECK • SPECIAL VALVES • FIRE HYDRANTS

20,000 B/SD delayed coker on stream for Mobil Oil Co. at Beaumont, Texas

CHARGES MIXTURE OF SWEET AND SOUR CRUDE RESIDUA

The new 20,000 barrel per stream day delayed coking unit – designed, engineered and constructed by The Lummus Company for Mobil Oil Company at their Beaumont, Texas Refinery – is on its initial run after very smooth start-up operations.

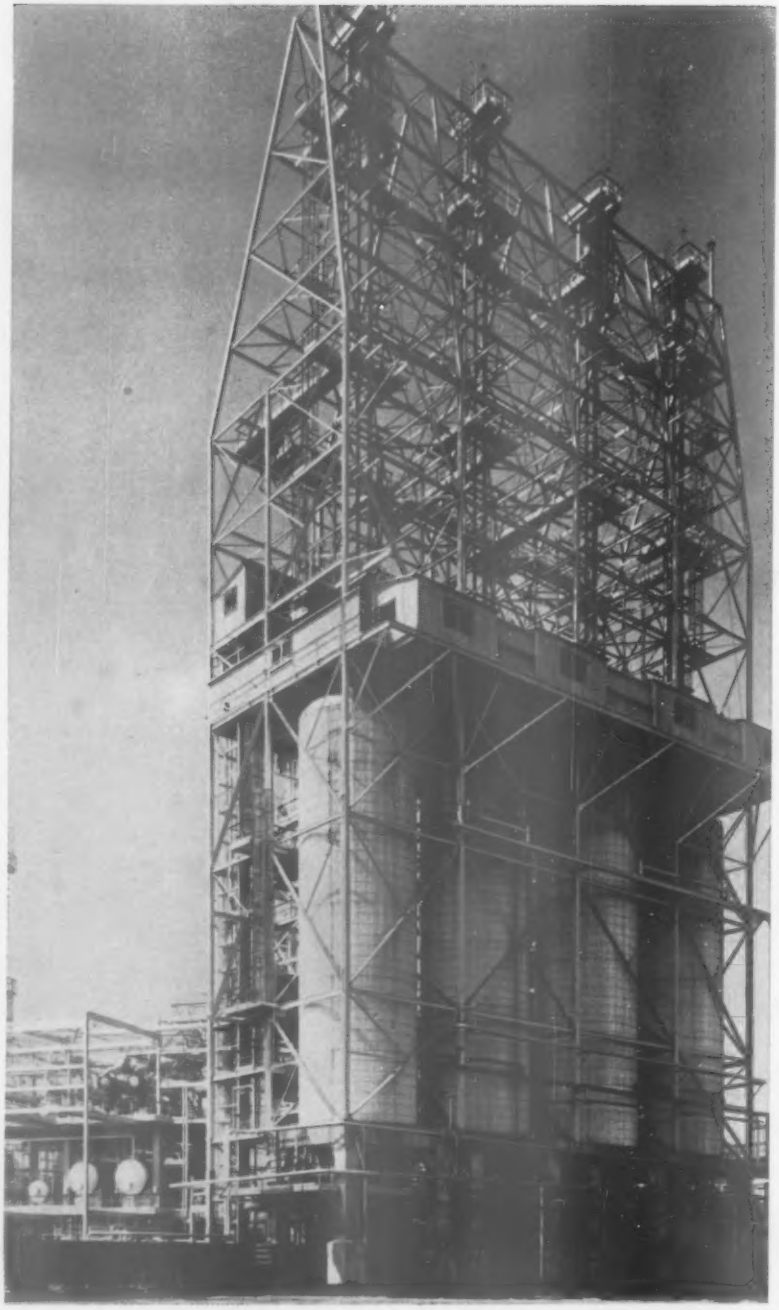
The Coker, comprising 4 coke drums each of 19 feet in diameter by 63 feet tangent to tangent, is designed for 732 tons of coke per stream day.

The feedstock is a mixture of sweet and sour reduced crudes cut back with naphtha to reduce the viscosity of the heavy residuum without the necessity of heating long lines. The unit includes a pre-flash section to separate the naphtha cutter stock from the heavy residuum before charging to the coking section.

The coker makes 5 products besides coke: gas, debutanized gasoline, light naphtha, and light and heavy gas oils.

Coke, which is hydraulically cut from the coke drums, is dropped directly into gondola railroad cars for final shipment.

A unique blow-down system conceived by Mobil has been incorporated for greater efficiency in recovering oil which has been stripped from the coke in the drum.



This is the 14th delayed coking unit engineered and constructed by Lummus. Lummus has built over 30% of the total existing delayed coking capacity in the United States.

LUMMUS®

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, New York, Houston, Washington, D. C., Montreal, London, Paris, The Hague, Madrid; Engineering Development Center: Newark, New Jersey.

Regular Submersible

SUBMERSIBLE PUMPS

deliver water

economically

consistently

silently

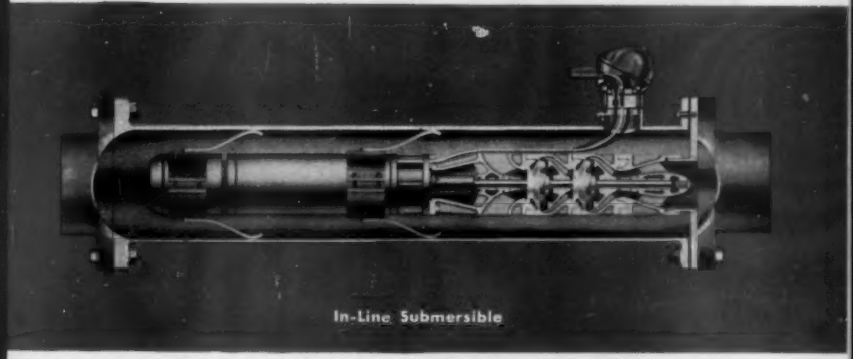
efficiently

The Layne Submersible Pump installation gives you noise free operation because the pump and motor are completely submerged. The Layne Submersible is adaptable to all wells; requires a minimum of space since no pump house is required; eliminates possibility of water contamination; and eliminates the opportunity for vandalism or other accidental mishap or damage.

Layne Submersible Pumps are available for wells as small as 6 inches and in capacities from 30 GPM up. For additional information write for free bulletin number 202.

The Layne In-Line Submersible pump provides the answer to many problems in booster pump applications. The pump operates as an integral part of the line and is designed for use by municipalities, industry, such as petroleum and chemical plants and by agriculture. Advantages include: simple installation, no additional space required, continuous service even under flood conditions, and no possibility of surface water contamination.

Layne In-Line pumps are made as small as 4 inch bowls on a 4 inch motor for use in a 6 inch pipe to deliver 30 GPM. Larger sizes are available as required. For additional information write for free bulletin number 203.



In-Line Submersible

Layne SINCE 1882 — COMPLETE WATER SERVICE

LAYNE & BOWLER, INC., MEMPHIS

General Offices and Factory, Memphis 8, Tenn.

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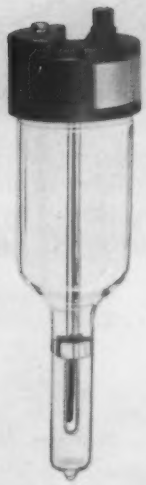
Find LAYNE Fast in the Yellow Pages under pumps



...with new rugged 7" reference and 3¼" glass electrodes...

new industrial pH system stresses reliability, flexibility

Beckman, world leader in pH instrumentation, introduces the all-new Model J pH System: compact transistorized analyzer, short, rugged electrodes, and accessory mounting assemblies. Here's continuous analysis equipment which provides reliability, flexibility, and convenience never before possible in industrial applications.

Check these Model J features, then see your Beckman Sales Engineer or Recorder Company Salesman for complete details, or write for Data File 24-50-06.

READOUT FLEXIBILITY. Available with both ma and mv output for use with any potentiometric or current recorders and controllers–or, with mv output only–recorder scale may be expanded to any 2 pH span full-scale. High or low alarm feature may be added.

SOLID-STATE ELECTRONICS. Assures reliability and saves long-term maintenance costs.

QUICK-DISCONNECT ELECTRODES. Short, rugged glass and reference electrodes feature capscrew for quick connect-disconnect of spade lug connectors. Speeds installation and replacement of electrodes.

DRIFT-FREE OPERATION. AC chopper amplification provides stability of 0.01 pH/24 hrs. over a −20°F to +122°F ambient temperature range.

HIGH ACCURACY AND SENSITIVITY. Output accuracy and meter sensitivity is ±0.02pH for full 0-14 pH or 0-±1400 mv range.

SIMPLIFIED MAINTENANCE. Plug-in components and circuits, rail-mounted analyzer chassis assure ease of maintenance, reduce downtime.

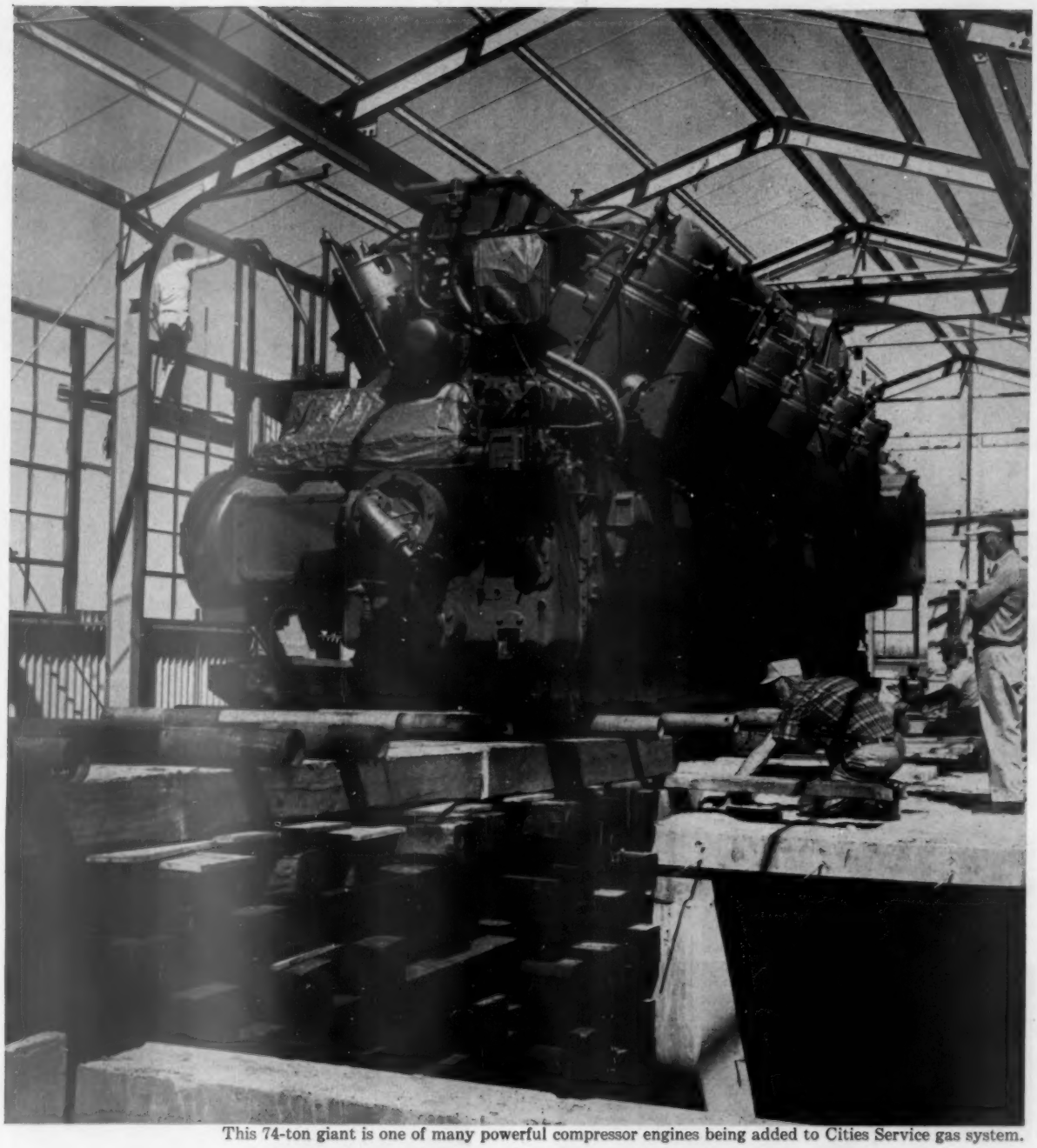
MINIMUM PANEL SPACE. Compact analyzer complements miniature current recorders, mounts in 6" x 6" cutout.

ACCESSORIES FOR YOUR REQUIREMENTS. Variety of flow chambers and immersion and submersion units adapt Model J System to your present and future plant applications.

Beckman INSTRUMENTS, INC.

SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION

Fullerton, Calif.



This 74-ton giant is one of many powerful compressor engines being added to Cities Service gas system.

Cities Service on the move

New families, new homes . . . new processes, new products, new plants . . . the demand for natural gas grows and grows. To meet this demand, new pipelines are laid, new storage facilities constructed, new and mightier compressors installed. Every day Cities Service adds to the hundreds of billions of cubic feet of this versatile fuel it supplies to utilities serving American homes and factories.

It is the same story with petroleum and its many products, from asphalts and heating oils to high octane gasolenes and petrochemicals. In every area of its interest, constantly expanding and improving its ability to meet the growing need . . . *Cities Service is on the move!*

CITIES SERVICE

NOW REPUBLIC PUTS THE

INTERNAL CLEANING HEAD with counter-rotating wire brush assembly moves through pipe and returns.

EPOXY RESIN OR OTHER MATERIAL is dispensed to desired thickness through self-propelled airless spray head.

LINING IN FUSION WELD!

Save time and trouble by letting Republic be your single source for internally coated fusion weld line pipe.

At the Gadsden (Alabama) pipe mill, Republic has the know-how and the facilities to apply coatings precisely as specified. Pipe is thoroughly cleaned before coating. It is then sprayed with a film of epoxy. Everything takes place under roof, and the pipe remains under cover until the coating is thoroughly dry.

Straight and strong, Republic Fusion Weld offers constant circumference, uniform wall thickness, and accurate size. Pipe is produced in 24″ through 30″ O.D., in lengths to 60 feet.

For complete information on fusion weld and internal coatings for fusion weld, contact your nearest Republic sales office. Or mail the coupon on the following page.

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Strong
Modern
Dependable

REPUBLIC STEEL

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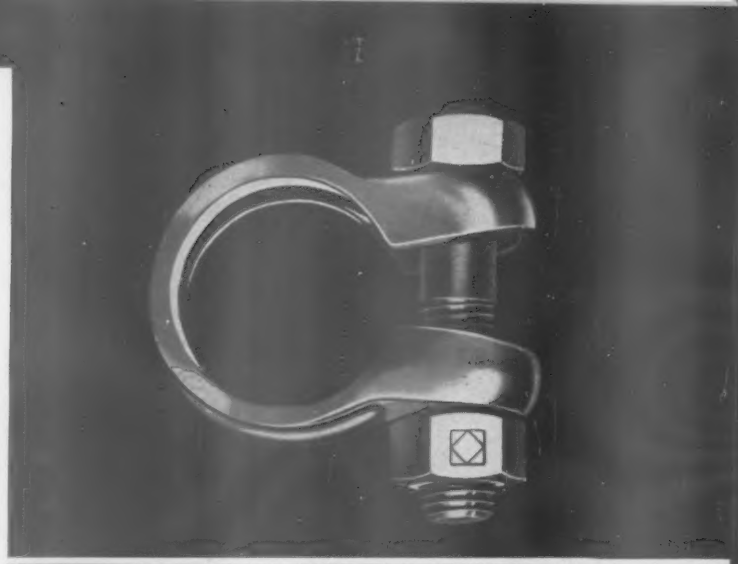
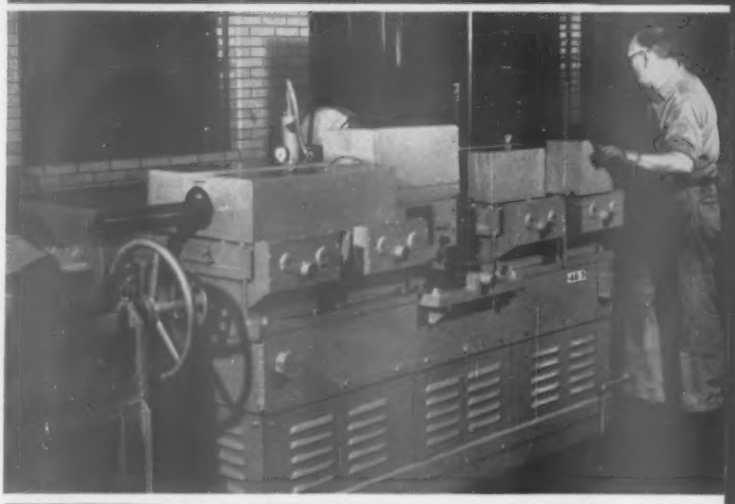
ELECTRIC WELD • FUSION WELD • SEAMLESS • CONTINUOUS BUTT WELD • LIGHT WALL • X-TRU-COAT • PLASTIC PIPE

FOR GREATER RELIABILITY...



A SINGLE UNIT ANSWER TO VIBRATION

Republic NYLOK® Bolts and Nuts with special nylon inserts require no cotter pins, set screws, lock washers, or wiring of heads. Nylon pellet produces a permanent lateral thrust against opposite mating threads, blocks fluid flow around helix of threads. The relatively inert nylon resists age and moisture, is unaffected by temperature extremes, and its natural resiliency permits easy adjustment and repeated use.



A BETTER TEST FOR TUBING

With Republic ELECTRUNITE® Heat Exchanger Tubing, you can specify FARROWTEST® nondestructive testing at no extra cost. Offered as an alternate to other less positive tests, FARROWTEST is an electronic method of detecting and rejecting tubing containing critical defects. ELECTRUNITE Tubing is formed from highest quality flat rolled steel—carbon or stainless—and welded without the addition of foreign metal. Mail coupon for complete information.

A BETTER PIPE FOR SOUR CRUDE

Republic SRK® Plastic Pipe has been used for more than three years by the R. S. Anderson Oil Company, Midland, Texas. In lines once replaced every six to eight months, SRK is still in service. Anderson reports no corrosion, no evidence of chemical action in general, very little damage from abrasion. Savings—already estimated at 50%—continue to grow. Republic SRK is available in a wide range of pressure ratings and sizes from ½" through 8". Return coupon for data.

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- ☐ NYLOK Bolts and Nuts
- ☐ FARROWTEST
- ☐ ELECTRUNITE Heat Exchanger Tubing
- ☐ SRK Plastic Pipe

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THEY SAY

It would be crowded

Dear Sir:

I wish to call your attention to a typographical error in your issue of November 20 ("Winter-drilling record on way in northeastern B. C.," p. 144) that could cause some confusion outside of Canada as to the size of Fort Nelson . . . I quote:

"The area covers nearly 6,400 acres."

A glance at a map shows that undoubtedly it was your intention to use "square miles" in this instance.

John H. Van de Venter
Canadian Division Manager
Western Natural Gas Co.

We should have said square miles. There's far too much activity in the Fort Nelson area to cram into only 6,400 acres—Ed.

A common cause

Dear Sir:

I am highly pleased with the treatment which I have received from all of you gentlemen (OGJ, Nov. 20, p. 120).

After all, we are laboring in the vineyard together, dedicated to a common problem . . . namely to be of service to the American Petroleum Institute, the American petroleum industry . . . and the American public.

L. F. McCollum
President
Continental Oil Co.

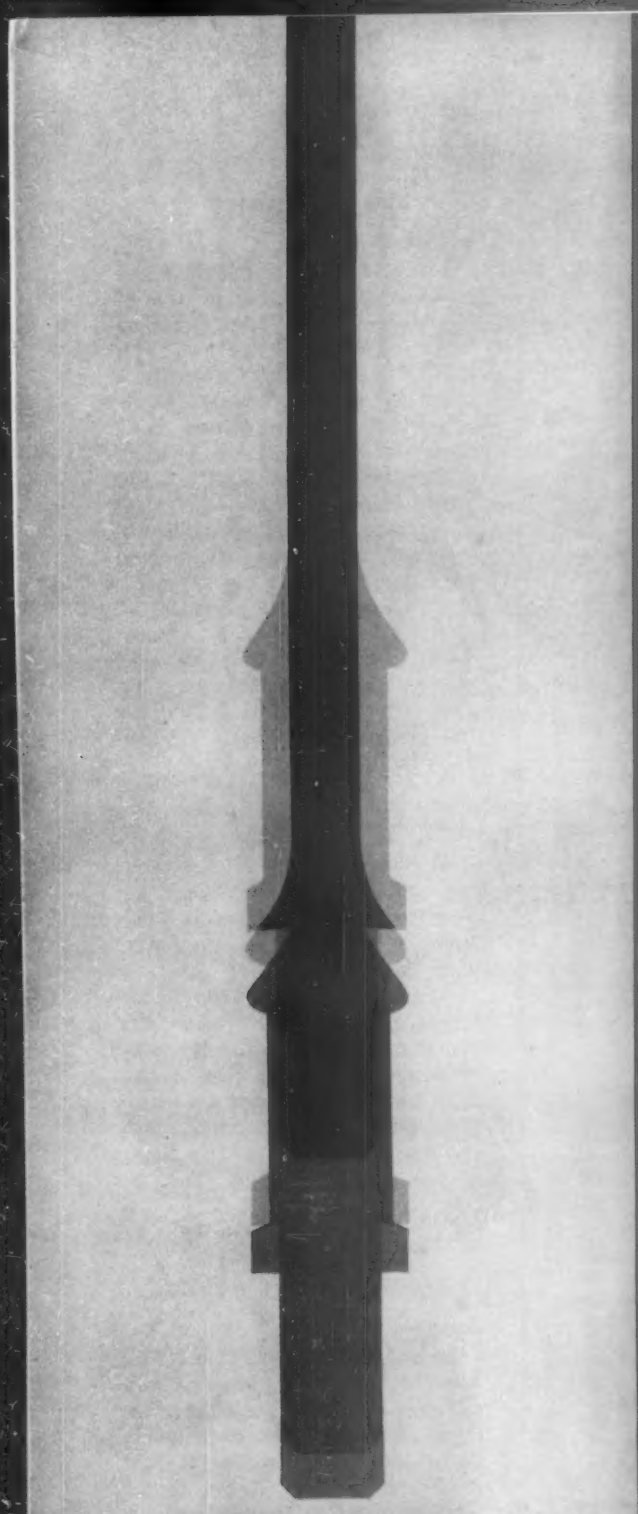
Geological talent wasted

Dear Sir:

Bravo for Louie Sebring (OGJ, Nov. 20, "Who gets there first with the most—company geologist or independent?," p. 263). As a family breadwinner and an independent consulting geologist, I revel in the freedom of action and the incentive to compete for ideas and capital.

However, as a member of the oil industry and a citizen, I view with alarm the tremendous waste of geological talent in organized exploration efforts.

The great challenge to exploration managements, whether they manage one geologist or hundreds, is to provide incentive and freedom



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SR11-31

of action for their talented men and to keep their organizations from becoming the refuge of empire builders and corporate bureaucrats. Fortunately for the independents, they seem to be failing miserably by and large.

Ed A. Gribi, Jr.
Geologist
King City, Calif.

High runs justified?

Dear Sir:

The editorial of November 6 (p. 65) insults the intelligence of the readers and questions the competence of management.

Although weakly stating otherwise, the insinuation is strong that a combine is necessary to control refinery runs and collusion would be welcome. If such an attitude is prevalent throughout the industry, it only preludes further socialization of the industry.

Refinery runs may be high, but only in a healthy way. The majors are expanding and going "national" with an optimistic view of maturing war babies and higher gross national product. To be able to enjoy the coming boom, the groundwork is now being laid.

If this means high refinery runs and price cutting, it should be welcomed for the optimistic view of the future and the healthy competition which insures a minimum amount of government intervention.

Paul M. Gagnon
Edmonton, Alta.

Oil workers set example

"Right at the moment there is no oil field unemployment in the (Great Bend, Kans.) area. There are jobs available for anyone who wants to and can work. So reports the Kansas State Employment Service. That hasn't been true every month in the past several years of oil development decline. But it points up a characteristic of the oilman.

"Unquestionably the total number of oilfield jobs in this area is down from its peak. But there is no pool of unemployed left by this changing situation.

"The coal miner or the textile mill worker may lean up against the employment office wall and draw compensation, but the oilfield worker adjusts to his situation. He gets another job, here or where the jobs are. He isn't afraid to move or to take up some new vocation. He doesn't expect the Government to support him or find him a new job.

"He is independent and resourceful, intelligent and energetic."

Editorial, Great Bend (Kans.) Daily Tribune.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JANUARY

7-10 Pipe Line Contractors Association, annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.
8-12 Society of Automotive Engineers, annual meeting, Cobo Hall, Detroit.
16-18 Kentucky Petroleum Marketers Association, annual meeting, and convention, Brown Hotel, Louisville, Ky.
17-19 National Association of Corrosion Engineers, Canadian region eastern division conference, King Edward Hotel, Toronto.
19 Natural Gas Processors Association, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.
24-26 American Society of Mechanical Engineers, second symposium on thermophysical properties, Princeton University, Princeton, N. J.
24-26 Texas A&M College, symposium on instrumentation for the process industries, Memorial Student Center, College Station.
31-Feb. 1 National Petroleum Refiners Association, Gulf Coast regional meeting, Ben Milam Hotel, Houston.

FEBRUARY

4-7 American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles.
12-13 Missouri Oil Jobbers Association annual convention and trade exhibit, Hotel Chase, St. Louis.
14-16 Southwestern Legal Foundation, annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.
14-17 Pipe Line Contractors Association of Canada, Castle Harbor Hotel, Bermuda.
16 Natural Gas Processors Association, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette.
18-22 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, New York City.
22 Chemical Institute of Canada, protective coatings division, Seaway Hotel, Toronto.
23 Chemical Institute of Canada, protective coatings division, Windsor Hotel, Montreal.
28-Mar. 2 American Petroleum Institute, Division of Production, southern district meeting, Rice Hotel, Houston.

MARCH

1-2 Southwestern Legal Foundation, conference on economics of gas industry, Southwestern Legal Center, Dallas.
2 Ohio Oil and Gas Association, winter

TRANSWESTERN PIPELINE COMPANY
MEASUREMENT DEPARTMENT
SULPHUR DETERMINATION TEST REPORT

Company or Producer: T W P L Co. Date: 3-9-61
Contract Number:
Field or Location:
Source or Reservoir: Strawn
Field & Res. No.:
Well or Station Name: Eaton
Station Number:

Analysis of gas for H_2S, RSH, RSR & RSSR using Austin Titrator

Bromine titration results expressed in milliamperes generating current required to maintain a fixed level of free bromine in the generating cell during selective scrubbing processes. Gas flow set at 500 cubic centimeters per minute.

Test Data

A. Blank (filtered sulphur free gas)	.080 ma.
B. Total Sulphur (unscrubbed gas)	1.036 ma.
C. H_2S removed (selective scrubber)	.865 ma.
D. H_2S & RSH removed (selective scrubber)	.373 ma.
E. H_2S, RSH & RSR removed (selective scrubber)	.175 ma.
A¹ Blank rerun (if A¹ ≠ A, rerun)	.080 ma.

Calculations

Sulphur Derivative		Equation	Grains/100 CF
H_2S	Hydrogen Sulfide	.52 x (B-C)	.089
RSH	Mercaptans	.44 x (C-D)	.216
RSR	Sulfides	.90 x (D-E)	.178
RSSR	Residual Sulphur	.50 x (E-A)	.048
	Total Sulphur		.531

Remarks:
Analysis By: D J Robertson Witness by:
FORM TW-240

Maloney-Crawford solves Another sour gas problem

TRANSWESTERN PIPELINE CO.'S PROBLEM: An 18 MMSCF/D stream with 100 grains H_2S/100 CF.

THE REQUIREMENT: Reduce H_2S to .25 grains/100 CF to meet pipeline specifications and dehydrate gas to 6.5 pounds H_2O/MMCF.

M-C'S SOLUTION: An automated Sweet-A-Mine gas treating plant with ratio-rate control system and a DU Series glycol dehydrator.

THE RESULT: The Sweet-A-Mine reduced the stream's H_2S content to .089 grains/100 CF, the actual Transwestern field report shown above verifies. The dehydrator met the water extraction requirements with ease.

CONCLUSION: If you have a sour gas problem, send it to M-C. You'll get an authoritative solution.

Maloney-Crawford

Designers and Manufacturers of Processing and Production Equipment

Box 659 Tulsa

meeting, Deshler Hilton Hotel, Columbus, Ohio.

4-8 American Society of Mechanical Engineers, gas turbine-process industries conference, Shamrock Hilton Hotel, Houston.

6-7 National Petroleum Refiners Association, eastern regional meeting, Sheraton-Cleveland Hotel, Cleveland.

13-15 Symposium on Application of Statistics and Computers to Fuels and Lubricants Research Programs, sponsored by research branch, office of the chief of ordnance, Department of the Army, Granada Hotel, San Antonio.

15-16 Society of Petroleum Engineers of AIME, economics and valuation symposium, Dallas.

16 Natural Gas Processors Association, Oklahoma regional meeting, Sheraton-Oklahoma Hotel, Oklahoma City.

19-22 Kentucky Petroleum Marketers Association, management institute conducted by the University of Louisville, Brown Hotel, Louisville, Ky.

21-23 New England Gas Association, annual meeting, Statler-Hilton Hotel, Boston.

21-23 American Petroleum Institute, Division of Production, southwestern district meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, joint annual meeting, Fairmont Hotel, Civic Auditorium, San Francisco.

27-29 American Society of Mechanical Engineers, power conference, Sherman Hotel, Chicago.

APRIL

2-4 National Petroleum Refiners Association, annual meeting, Granada Hotel, San Antonio.

3 Chemical Institute of Canada, chemical economics division conference, Royal York Hotel, Toronto.

4-6 API, Division of Production, Mid-Continent district meeting, Sheraton Oklahoma Hotel, Oklahoma City.

5-6 Society of Petroleum Engineers of AIME, upper Gulf Coast region, drilling and production practices conference, Beaumont, Tex.

9-10 Instrument Society of America, national chemical and petroleum instrumentation symposium, Wilmington, Del.

9-11 Mid-West Gas Association, annual meeting, Hotel Radisson, Minneapolis.

9-12 National Oil Fuel Institute, national oil heat and air conditioning exposition, Chicago.

11-12 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, convention and exposition, Dallas.

11-13 API, Division of Production, Rocky Mountain district meeting, Hilton Hotel, Denver.

12-13 Society of Petroleum Engineers of AIME, new petroleum production and reservoir engineering developments, Mayo Hotel, Tulsa.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel, Boca Raton, Fla.

15-19 American Society of Mechanical Engineers, oil and gas power division conference, Shoreham Hotel, Washington.

17 Society of Plastics Engineers, Philadelphia section, regional technical conference, Sheraton Hotel, Philadelphia.

17-19 Southwestern Gas Measurement Short

diversity

A business school prof might call it product diversification to broaden the marketing base, but it all boils down to the basic American drive for a better standard of living. But, all is not so crass! This base broadening business brings *you* the products you need to set your own standards. And since most of our products were designed to meet specific customer demand, we've had a hand jacking up quite a few standards. Before we get too philosophical, let's look at the many things Hoke makes:

1 FORGED NEEDLE VALVES 300 Series:
3000 psi
Brass, 303 SS, 316 SS, Monel
Aluminum ⅛" to ⅜" NPT and with integral tube fittings

2 BAR STOCK NEEDLE VALVES 270 Series:
3000 to 5000 psi
Brass, 430F SS, 316 SS, carbon steel, carbon steel and SS
⅛" to ½" NPT and with integral tube ends

3 PRESSURE REGULATORS 880 Series (gen'l purpose):
Max. delivery press. 140 psig
Max. inlet press. 2500 psig
¼" NPT male needle valve outlet Std. CGA inlet

4 CHECK VALVES 570 and 580 Series:
2000, 3000, 5000 and 6000 psi
Brass, 303 SS
⅛" to ½" NPT and with integral tube fittings.
Ball and piston types

5 SOLENOID VALVES Series 90 (2-way type): Series 95 (3-way type):
Differential press. ratings to 2000 psi
Brass, 303 SS
⅛" and ¼" NPT or JIC tube connections
Choice of coils, housings, corrosion-resistant trim

6 BAR STOCK NEEDLE VALVES 280 Series (metering):
3000 psi
Brass, 316 SS
⅛" and ¼" NPT
1/16" and ⅛" orifice

7 PACKLESS VALVES 473 Series (bellows seal):
400 and 2000 psi
316 SS
½" NPT

8 PRESSURE REGULATORS 920 Series (ballast operated):
Max. del. press. 4500 psig
Max. inlet press. 5000 psig
¼" NPT inlet and outlet

9 FORGED NEEDLE VALVES 100 Series
10,000 psi (WOG)
Weldable forged carbon steel
⅛" to ½" NPT

10 SAMPLING CYLINDERS
Service press. 400 and 1800 psi
304 SS
⅛" to ½" NPT outlet
Single or double valve types
Sizes 10 ml. to 1 gallon

11 TOGGLE VALVES 490 Series (cam-closing):
1000 and 2000 psi
Brass, 303 SS
⅛" to ½" NPT

12 TOGGLE VALVES 450 Series (spring-closing):
200 psi
Brass, 303 SS
⅛" to ⅜" NPT and with integral tube fittings

13 PRESSURE SWITCHES PSG-375 Series:
Operating range 15 psig to 500 psig (max. setting)
Aluminum and SS housing
Proof Press.— 150% max. operating pressure
Burst Press.— 250% max. operating pressure
⅛" NPT port or AND 10056-4, 37½° flare

14 PACKLESS VALVES A431 Series (brass bellows seal):
400 psi
Brass
⅛" and ¼" NPT

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Course, University of Oklahoma, Norman.

17-19 American Society for Metals, regional conference and exhibition, materials and materials processing for the petroleum, petrochemical and chemical industries, Shamrock-Hilton Hotel, Houston.

23-25 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Salt Lake City.

24-26 American Society of Mechanical Engineers, production engineering conference, Van Curler Hotel, Schenectady, N. Y.

25-27 Natural Gas Processors Association annual convention, Hilton Hotel, Denver.

29-May 1 Independent Petroleum Association of America, midyear meeting, Hotel Muehlebach, Kansas City.

29-May 1 Empire State Petroleum Association, spring convention, Statler-Hilton Hotel, Buffalo, N. Y.

29-May 2 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

30-May 2 Southern Gas Association, annual meeting, and American Gas Association, transmission conference, Rice Hotel, Houston.

30-May 2 API, Division of Transportation, annual tanker conference, Del Monte Lodge, Pebble Beach, Calif.

MAY

2-4 API, Division of Finance and Accounting, midyear meeting, Americana Hotel, Bal Harbor, Fla.

4 Chemical Institute of Canada, rubber chemistry division, Niagara Falls, Ont.

7-8 Society of Petroleum Engineers of AIME, North Texas section, fifth biennial secondary recovery symposium, Wichita Falls, Tex.

7-8 American Society of Mechanical Engineers, maintenance and plant engineering conference, Royal Orleans Hotel, New Orleans.

10-11 API Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

11 Natural Gas Processors Association, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

11-12 Kansas Independent Oil and Gas Association, annual meeting, Broadview Hotel, Wichita.

14-17 API, Division of Refining, midyear meeting, Fairmont and Mark Hopkins hotels, San Francisco.

16-18 API, Division of Production, eastern district meeting, Deshler Hilton Hotel, Columbus, Ohio.

17-18 Society of Petroleum Engineers of AIME, production automation meeting, Hobbs, N. M.

20-23 American Institute of Chemical Engineers, national meeting, Lord Baltimore Hotel, Baltimore.

22-23 National Petroleum Refiners Association, computer conference, Ben Milam Hotel, Houston.

22-25 API, Division of Marketing, midyear meeting, Queen Elizabeth Hotel, Montreal.

23-25 API, Division of Transportation, annual pipeline conference, Denver Hilton Hotel, Denver.

23-25 Eleventh National Telemetering Conference, Sheraton-Park Hotel, Washington.

24-25 AIME, Rocky Mountain petroleum sections, annual joint meeting, Billings, Mont.

27-30 Chemical Institute of Canada, Canadian chemical conference and exhibition, Macdonald Hotel, Edmonton.

JUNE

4-6 American Society of Mechanical Engineers, lubrication symposium, Deauville Hotel, Miami Beach.

5-7 American Society of Mechanical Engineers, fuels symposium, Rutgers University, New Brunswick, N. J.

10-15 American Society of Mechanical Engineers, summer annual meeting, Chateau Frontenac, Quebec.

13-14 National Petroleum Refiners Association, Mid-Continent regional meeting, Lassen Hotel, Wichita.

20-23 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Que.

24-29 American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, New York.

25-26 Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.

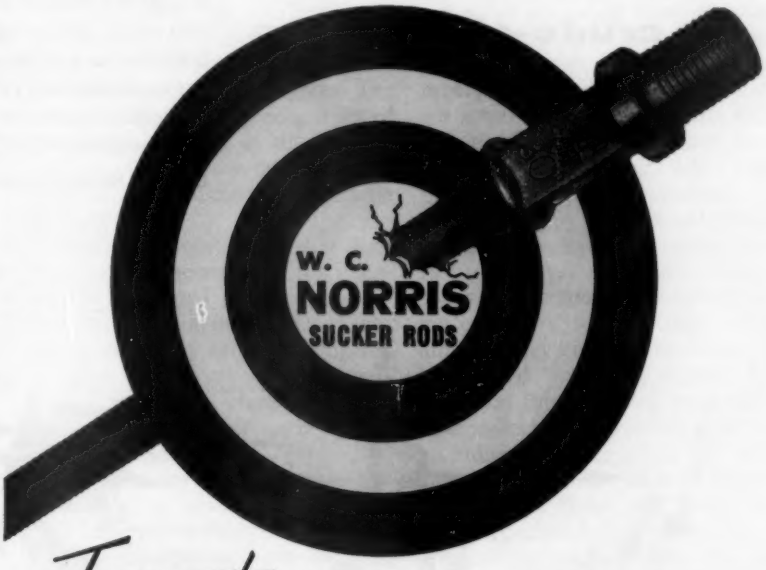
25-27 American Association of Cost Engineers, national meeting, Edgewater Beach Hotel, Chicago.

27-29 Automatic Control Conference, sponsored by Instrument Society of America, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, and Institute of Radio Engineers, New York University, New York.

27-29 American Society of Mechanical Engineers, joint automatic control conference, New York University, New York.

AUGUST

5-8 American Institute of Chemical Engineers, American Society of Mechanical Engineers, national conference on heat transfer, Shamrock Hilton Hotel, Houston.



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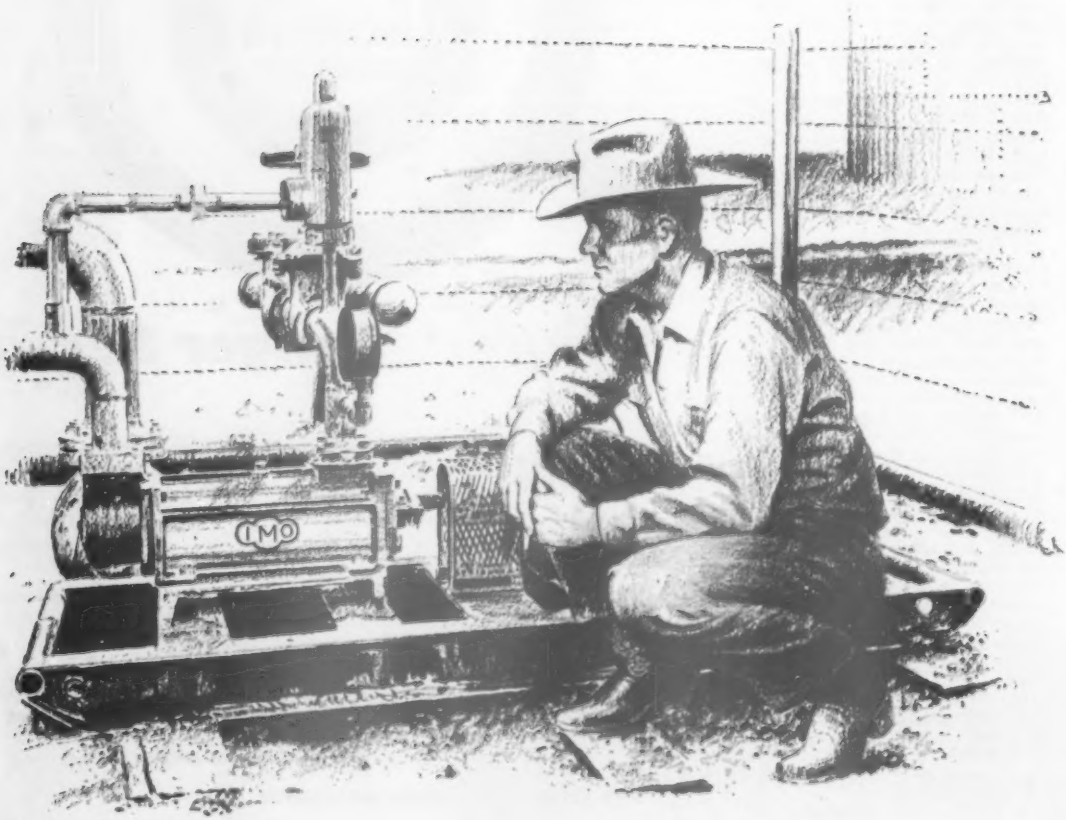

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THE JOURNAL SAID

50 years ago

December 14, 1911

Reports by the department of engineering at the University of Kansas that the available supply of gas from Kansas and Oklahoma fields will be exhausted in less than 3 years are leading Kansas City to start agitation for the installation of an artificial-gas plant to supply the city's needs.

The new Electra field, near Wichita Falls, in North Texas, becomes the busiest oil play in the country. Forty-two wells are drilling and rigs are going up for 26 others. Daily production has risen to 10,000 bbl. from the 46 wells brought in so far. Opening of a deep sand at 1,060 ft. was reported last week. Both Magnolia Petroleum Co. and The Texas Co. are rushing work on pipelines from the field. Market price for the oil is 55 cents.

25 years ago

December 10, 1936

United States District Court at Los Angeles sanctions reorganization of Richfield Oil Co. and its subsidiary, Pan American Petroleum Co. and their merger with Rio Grande Oil Co. The reorganization and merger give the West Coast oil industry another major completely integrated company.

First oil production from the Teritiary formation in the Rocky Mountain region is found on the Powder Wash structure, in northern Moffat County, northwestern Colorado, near the Wyoming line. Its discovery well, Mountain Fuel Supply Co. 1 Allen, flowed 47½ bbl. of oil per hour with 5 M.M.c.f.d. of gas from the Wasatch section.

Oil properties of Thomas B. Slick estate and Slick-Urschel Oil Corp. are merged into the newly formed Transwestern Oil Co. of Oklahoma. The properties are spread over Oklahoma, Texas, and Kansas. Arthur A. Seeligson heads the new company.

10 years ago

December 13, 1951

Texas Illinois Natural Gas Co.'s newly completed 1,417-mile gas pipe line from Falfurrias, in far-South Texas, to Joliet, Ill., starts operating with special dedication ceremonies, attended by 400 guests. Lighting of flare by Chicago public-works commissioner signifies first use of gas through new $135,000,000 line.

Record number of rotaries is reported operating in the United States. The week's average totals 3,016, or 44 above that of the previous week, and 641 above average for same week last year.

JOURNALLY SPEAKING

Legal monopoly

THIS YEAR is the 125th anniversary of the American patent system. Patent lawyers have been making quite a fuss over it, such as holding celebration dinners and making speeches about how patents are the bulwark of free enterprise and technological advancement.

They are probably right about that, but not everybody agrees. The patent system comes under a lot of criticism from time to time, and a number of bills are pending in Congress to make some rather drastic changes in it.

From one point of view it does seem rather incongruous for a nation so dedicated to free competition to grant an individual an absolute monopoly on something for 17 years. On the other hand, Americans have always championed the principle of private reward for individual initiative.

The way our patent system has worked out in practice, it seems to have achieved a fairly happy compromise of this apparent conflict. Of the 3,000,000 patents issued, only a handful have given one individual a complete monopoly on something essential and for which there were no substitutes or alternatives.

The reason is that either somebody quickly invents something else just about as good, if not better, or else the patent is rather widely licensed to competitors at reasonable fees. Thus the monopoly aspect of patent rights has not held back industrial progress.

The oil industry could exhibit just about every aspect of this phenomenon, though it has been the scene of some very bitter patent litigation during its history.

The old Roberts torpedo for shooting wells was the first monopoly attempt that failed, back in the 1880's. Because the royalties were high and because any backwoods tinsmith could make the equipment, drillers thumbed their noses at the patent and no amount of infringement suits could stop "moonlighters" from shooting wells.

Today most completion methods, such as acidizing and fracturing, are either so widely licensed or are so little different from other patented processes that there is no monopoly. The investors usually get a satisfactory return from small royalties through widespread use.

Likewise in refining. When thermal cracking was first invented, one major company had a monopoly on low-cost gasoline. But competitors rushed to develop similar processes, some good, some bad, some infringing on others' patents. Before long almost every refiner was suing or being sued by all the others. The mess was finally settled by a series of crosslicensing agreements, setting an industry pattern which has been more or less followed ever since.

Nowadays fewer and fewer important patents are obtained by individual inventors. Most are the product of research teams in industrial laboratories. In the oil industry a common practice is for an oil company to obtain a patent on a new process or device and then give nonexclusive licenses to several service or equipment companies. Thus the whole industry gets the benefit on equal terms.

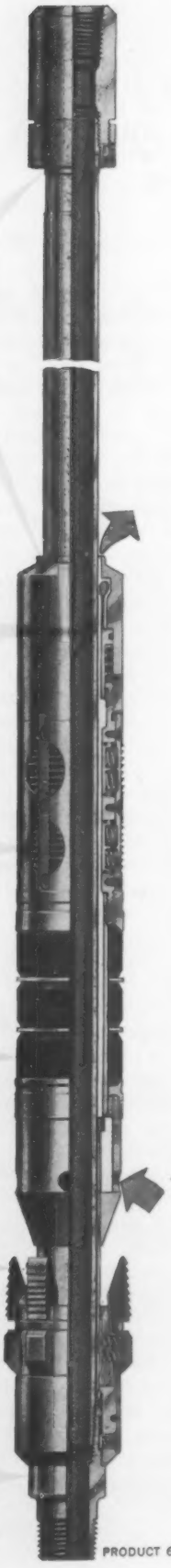
We have never seen any study of the role of patents in the technological progress of the petroleum industry. Other industries may have been boosted or retarded by the monopoly aspect of patents, but oil seems to be well adjusted to our 125-year-old patent system.

Perhaps the Roberts torpedo experience showed that, oil men being what they are, not even a legal monopoly can stand up against competition very long in the oil business.

—Henry D. Ralph

An advanced new packer for production and well-stimulation

THE *BAKER* MODEL "R" DOUBLE-GRIP RETRIEVABLE CASING PACKER



NEW
Face-Seal Bypass Valve
Seals instantly, is non-plugging

NEW
Differential Lock
Locks bypass valve closed; unlocks when tubing is picked up

NEW
Integral Hold-Down
Holds packer down, but does not interfere with use of bypass valve

Proven 3-Element Packing System

Dependable Rocker-type Slips

NEW
Automatic Bottom
Locks slips in retracted position when tubing is picked up

PRODUCT 642-R

A long-stroke (30″) packer with simple one-turn right control-pin setting, automatic bottom and hold-down... for combination acidizing, fracturing and production operations.

Now Baker brings new convenience, new reliability, to the familiar long-stroke production packer with hold-down.

This results from a new design concept that moves the hold-down from the tubing to the packer, placing it below the bypass valve. This restores surface control of the bypass valve for pressure equalization, eliminates button dulling, and provides dependable release of the hold-down.

And, back of the Model "R" is the Baker service organization. Domestically, 62 Baker field-service warehouses stand ready to supply packers, parts and repair service. Ask one of the 400 Baker servicemen to give you the complete story on both the Double-Grip and Single-Grip (no hold-down) versions of the Model "R" Packer.

HERE'S HOW THE NEW DESIGN CONCEPT WORKS...

(1) Note that the *Bypass Area* through the packer is completely isolated from the packer mandrel and tubing. Pressure surges in the tubing cannot dull buttons while running in or retrieving. Solids in tubing fluid cannot compact behind buttons and prevent retraction.

(2) Note that the *Hold-Down* is a part of the packer, not attached to the mandrel... leaving the bypass valve free for instant pressure equalization.

(3) Note that a *Differential Lock* holds the bypass valve closed without requiring high set-down weights... yet can be instantly released by picking up on the tubing.

The new concept in long-stroke packers is fully explained in Bulletin 385. Write: Baker Oil Tools, Inc., P. O. Box 2274 Terminal Annex, Los Angeles 54, California

BAKER
BAKER OIL TOOLS, INC.
HOUSTON / LOS ANGELES / NEW YORK

Do we really want free enterprise?

MARKETERS TODAY are caught up in an industrial revolution. The conventional ways of doing business are being challenged. Even the economics of doing business appears to be changing.

We're past the early stages—the advent of the superpremiums, the spread of multigrade marketing, the encroachment of the independents into the majors' share of the market. We have now arrived at that period in the revolution where a climax seems imminent.

Actions of the next few weeks may well determine tomorrow's marketing pattern. But there's an unanswered question which is more important than the precise form of tomorrow's operations. Who will be running the business?

A NEW AND STRANGE PHILOSOPHY appears to be gaining acceptance. Its adherents seem to feel that if you're being crowded into a corner by aggressive competition, or if your end of the business is being squeezed by other segments, you run to Washington and cry for help. You ask that big government step in and write new rules to soften the blows.

In the last month, for example, jobbers have resolved to ask a federal investigation of the producers' percentage depletion. Independent refiners have voted to plead their case before "every interested governmental committee . . . " A marketing group has resolved to push for divorcement of production from the rest of the industry.

Last week even an independent producer threw in the towel and told the Steed committee he'd rather have the federal Government divide the crude-oil market among the states than have the job done by "self-serving" private interests.

Major-company officials are even talking of asking the FTC to step in and write rules of "fair practices" for the nation's marketers to follow.

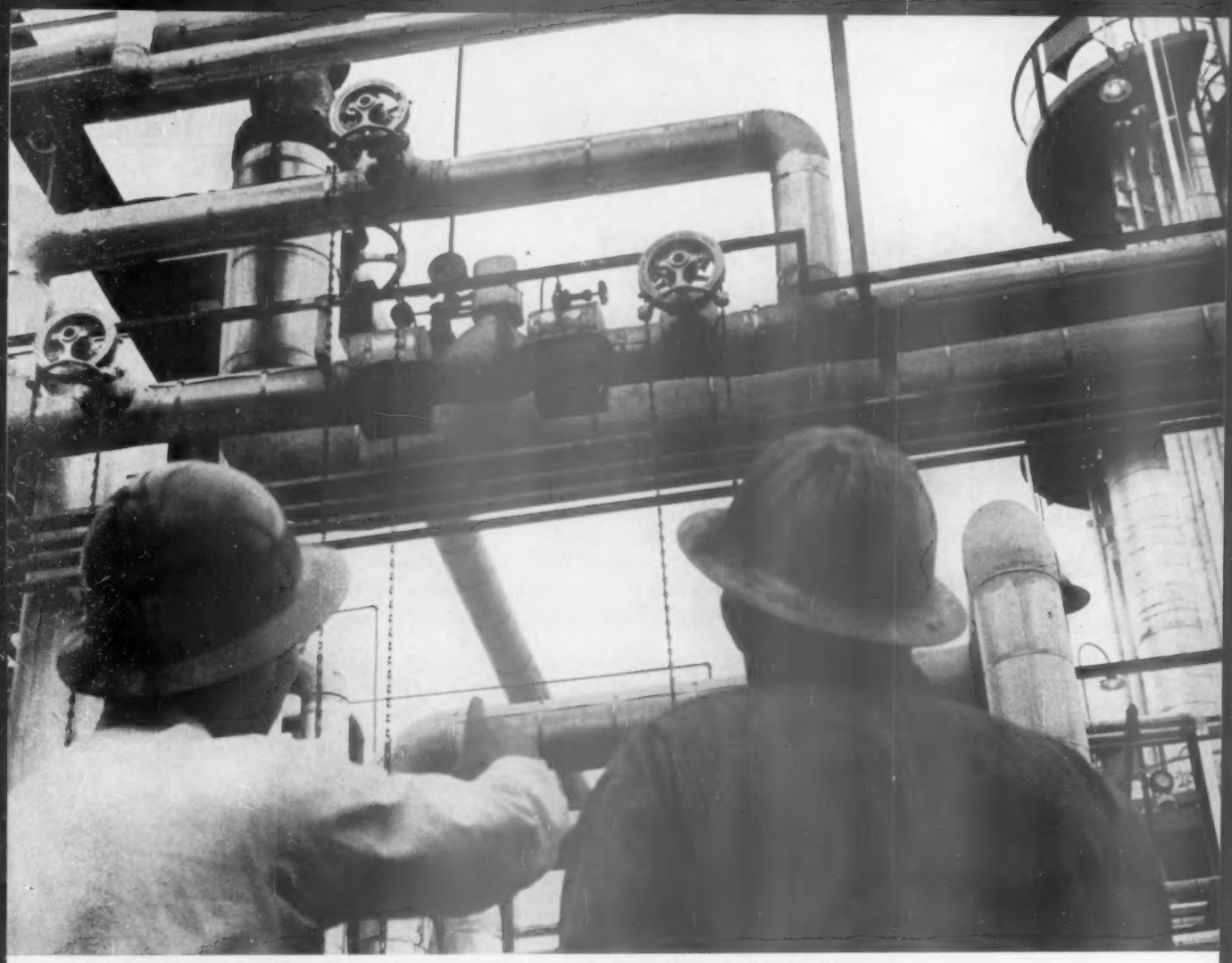
THE REAL QUESTION facing industry today is not whether subregulars are here to stay, nor whether blending pumps will multiply throughout the land, nor even whether price will settle at a 1-cent spread between skid and major.

It is simply this: Will tomorrow's signals be called by big government, or by free business men?

Government needs no urging to take over and run your business. It needs only the opportunity. If marketers keep asking Government to regulate producers, and independents keep calling for restrictions on the majors, there can be only one ultimate result.

Oil men must face up to the problem. Can we still meet new situations with ingenuity, determination, self-reliance, and the other old-fashioned virtues? Are we willing to risk some financial loss and competitive disadvantage to defend the principle of free competition? Or are we ready to admit that government planning, government control, and government operation are inevitable?

Do we really want free enterprise? Our actions in the next few weeks will tell.



Foxboro Target Flow Meter controls naphthalene on Hydeal Unit jointly developed by Universal Oil Products Co., Des Plaines, Ill., and Ashland Oil & Refining Co., Ashland, Kentucky.

Foxboro Target Flow Meters improve process control on Ashland Oil's huge naphthalene installation

The Foxboro Target Flow Meter installs directly in the line. Stainless steel disc extends into stream, senses force of fluid pushing against it. Force is converted to pneumatic signal proportional to the square root of flow and transmitted to a remote Foxboro recorder or controller.

Tap-less meters handle naphthalene, and heavier aromatics – without plugging, fouling or leaking

Every month, some 8 million pounds of high grade naphthalene flow out of Ashland Oil's new Hydeal Unit at Ashland, Kentucky. To help control process flows at top efficiency, Ashland Oil relies on Foxboro Target Flow Meters.

Molten, viscous naphthalene, for instance, pours through the Foxboro Target Flow Meters without setting up in the line. That's because the meters have no pressure taps to foul or plug-up. And the leak-proof, tap-less meters let Ashland Oil *safely* measure volatile and flammable fluids.

Foxboro Target Flow Meters take the guesswork out of measuring other hydrocarbons, heavy oils and viscous liquids, too. They introduce a standard of accuracy and repeatability previously unobtainable for these applications — right up to 750°F.

Find out now whether your tough flow measurement problems can be solved with Foxboro Target Flow Meters. For more complete details, write for Bulletin 13-31. The Foxboro Company, 6012 Neponset Avenue, Foxboro, Massachusetts.

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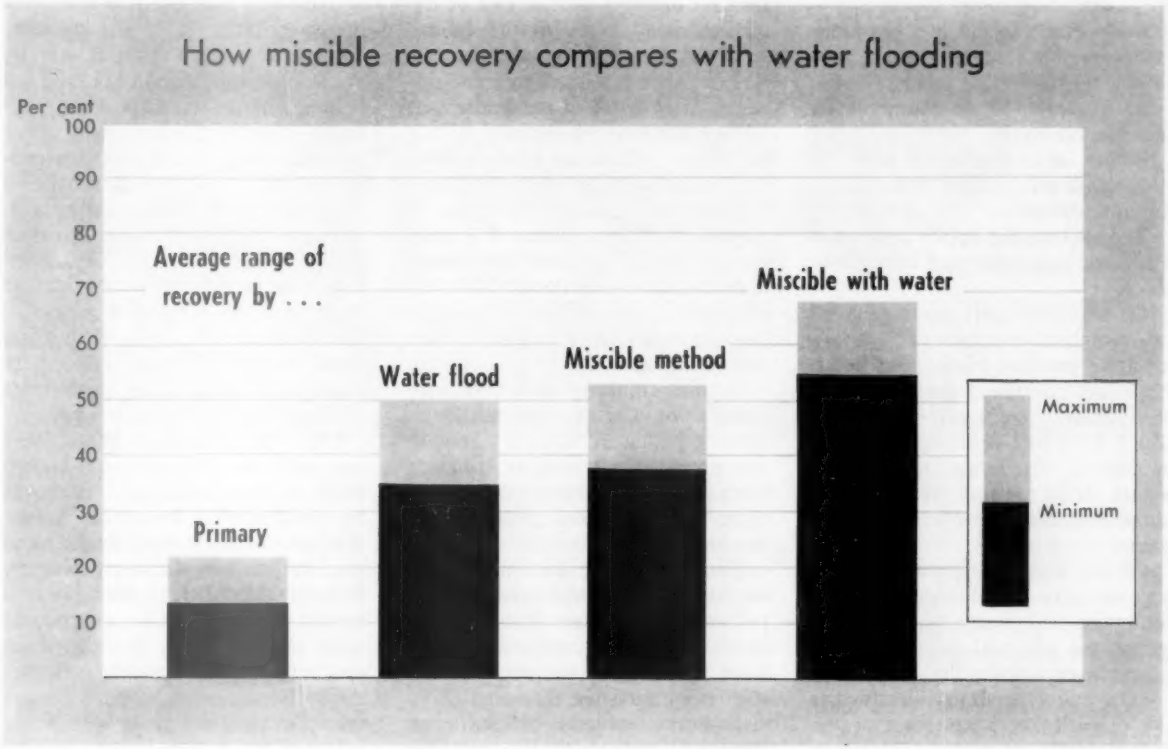


Are miscible floods worth the cost?

Experience indicates miscible drive recovers only slightly more oil than water flood. Since costs are high, incentive allowables are needed.

Robert J. Enright
Southwest Editor

MISCIBLE FLOODING, as an oil-recovery tool, isn't living up to producers' initially rosy expectations.

A wealth of performance data now are coming in from the rash of miscible drives started 4 to 5 years ago. And nearly every project is coming up with oil recoveries smaller than anticipated.

Volumetric sweep efficiency in each case has been poor. As operators predicted, the miscible drive is sweeping virtually 100% of the crude from the parts of the reservoir contacted by the liquefied petroleum gas or rich gas. But it is contacting a much smaller portion of the reservoir rock than expected.

Explanations for this vary. But operators all agree that this is what is happening.

Early results of more sophisticated projects kicked off in the past year or two have been more encouraging. Injection of alternate slugs of water and gas following the gas phase, for instance, appears to have improved the sweep.

But it's clear now that even such techniques as these will not boost the oil take from miscible projects to anywhere near the 80 and 90% so glowingly pictured 5 years ago.

10 to 15% more oil. Experienced miscible flooders generally agree now that the unadorned, garden variety of miscible project—a simple enriched-gas drive or a dry-gas driven slug of LPG—will recover only slightly more oil in most reservoirs than the time-honored water flood.

And the slight increase, they agree, wouldn't be economically attractive because of the miscible drive's much higher cost.

This isn't to say, however, that the miscible flood is proving a complete bust. Far from it.

Using the latest techniques to improve the sweep, an operator can hike the take from a carefully engineered project to perhaps as high as 60 to 65% of original oil, some engineers say.

Others, more conservative, figure 55 to 60% as about tops.

In either case, however, they

agree that this kind of streamlined operation will net 10 to 15% more of the oil originally in place in a reservoir than a water flood.

Costs climbing. Such a big jump in prospective recovery from a pool would seem, at first glance, sufficient incentive to operators to go the miscible route.

But it isn't. Operators now are starting fewer, rather than more, miscible drives.

The reasons are purely economic. They are high costs and low allowables.

On the one hand, costs of even the simplest miscible project are much higher than for a water flood. Liquefied petroleum gas in volume is expensive. So is gas. Just these, which were foreseen long ago, were enough to discourage many companies from getting very excited about miscible recovery in the first place.

Now it has been proved that this isn't enough—that the operator must follow up with water or water and gas to get any real increase in recovery over a water flood.

This merely tends to widen further the disparity between costs of the two methods.

As an illustration, Mobil Oil Co., starting in mid-1957, injected roughly 1,540,000 bbl. of propane and followed with 12 billion cubic feet of gas into the Bend reservoir in its big Parks Pennsylvanian field project in West Texas.

Its initial estimate of the cost of the project was $3,000,000.

Now Mobil is switching to water injection at Parks as a third phase of the project required to improve the sweep. This move wasn't contemplated at the start. And the company's early cost estimate did not include the added water-injection expense.

1. Allowable factor

Oil companies now are cost conscious. But it is not high cost alone that is retarding the start of more miscible drives. It is the cost combined with a lack of allowable incentive.

The allowable situation, operators say, is the real roadblock.

"Under current conditions," one operator says, "a pressure-maintenance water flood gets just as much allowable as a miscible drive in most states. So you're just spending much more money now to produce the same daily amount of oil. The benefit from the added reserves will be realized only on the tail end of the project many years in the future.

"This just isn't good business. Payout on the added miscible investment is so far in the future that we are forced economically to use the money elsewhere where profits can be generated much faster."

How much more allowable is needed to justify a choice of a modern miscible drive over a pressure-maintenance water flood? Different operators give different answers. One experienced miscible flooder says a minimum of 30% more.

Another thinks an allowable twice as high would be about right, though admitting that it wouldn't require this much of a bonus to influence him to install miscible projects where there was a choice between the two methods.

Thus the future for miscible oil recovery, as a method broadly competitive with water flooding, depends heavily on allowable treatment accorded by the various state regulatory agencies.

If future projects get sufficient incentive allowable, the miscible method will become one of the most commonly used tools in the industry's recovery kit.

If not, it will stagnate, with application limited narrowly to special reservoir situations—and with reserves it could add in other pools left behind.

Where it applies now. Such special situations, various operators tell the Journal, may include:

Tight formations where water injection would necessitate the drilling of many input wells and where injection of miscible fluids around the pool perimeter would be practical.

Thin porous zones where a miscible project could be rushed through to completion quickly.

Reservoirs where residual oil saturation following a water flood would be very high.

In each of these situations, however, there are other operators who still would hesitate to choose a miscible drive over a water flood.

Tertiary potential eyed. Some of the companies now ruling out miscible drives in fields where they can also water flood feel the real future of the miscible method lies in its use to skim off a third crop of oil.

Atlantic Refining Co., for one, is extremely interested in such tertiary recovery. It is already conducting one such project on its W. D. Johnson lease in South Ward field in West Texas—a lease previously water flooded with great success. Reports are that this project is doing well and that Atlantic is planning a second in another area.

Doyle Marrs, division engineer for Mobil at Midland, Tex., confirms that Mobil, too, is interested in miscible drives in flooded-out fields. The company, he says, is "looking into" the possibilities in pools where residual oil saturations after water flooding are known to be high.

Other than Atlantic's West Texas test, only one such venture is known to have been attempted. That was by Phillips Petroleum Co. in the shallow Burkett Bartlesville sand pool in Greenwood County, Kansas. Part of the LPG slug reappeared almost immediately in a producer some distance from the pilot five-spot. The project was dropped after about 2 years.

2. Sweep troubles

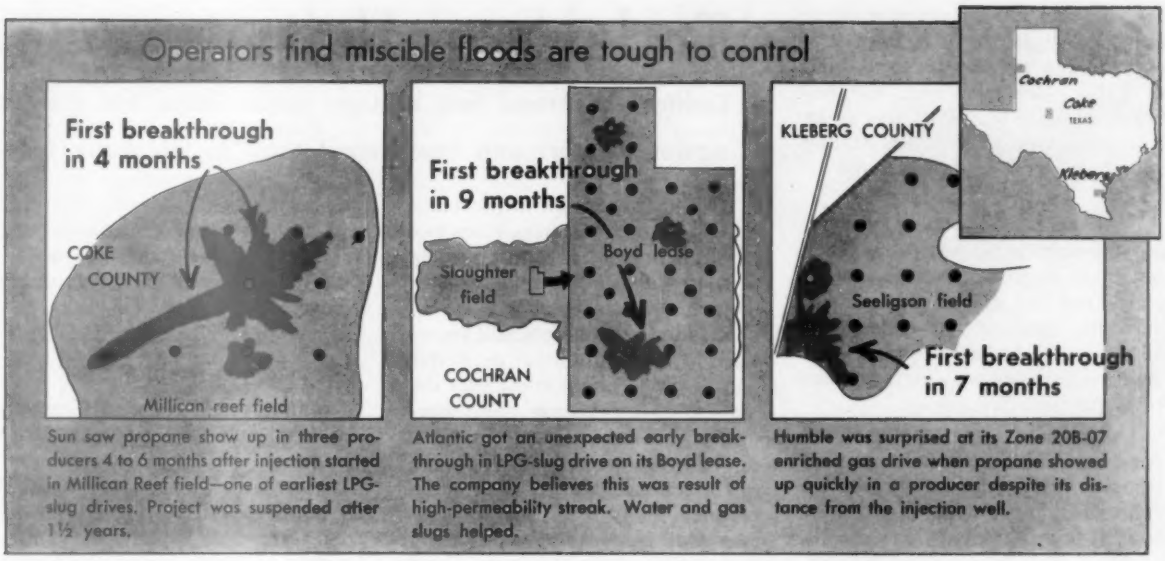
One of the first LPG-slug drives was started in Millican Reef field by Sun Oil Co. in September 1956. And its early results now can be regarded as a warning of what miscible flooders have generally experienced in other projects.

Propane broke through to three producing wells within 6 months. The breakthrough configuration indicated channeling. Though the project paid out in oil recovered, Sun engineers estimated that only 15 to 20% of the pilot reservoir volume was swept prior to breakthrough.

Other companies since have witnessed much of the same performance.

A preliminary analysis by Humble Oil & Refining Co., for instance, of its enriched-gas drive in the Zone 20B-07 reservoir in South Texas' Seeligson field cites a volumetric sweep efficiency at breakthrough of only 23%—as compared with "water flood sweep efficiencies in similar reservoirs of 50 to 60%."

Atlantic Refining Co. also has found sweep efficiencies poorer than it had calculated in its LPG-slug



Sun saw propane show up in three producers 4 to 6 months after injection started in Millican Reef field—one of earliest LPG-slug drives. Project was suspended after 1½ years.

Atlantic got an unexpected early breakthrough in LPG-slug drive on its Boyd lease. The company believes this was result of high-permeability streak. Water and gas slugs helped.

Humble was surprised at its Zone 20B-07 enriched gas drive when propane showed up quickly in a producer despite its distance from the injection well.

drive in Slaughter field in West Texas. So has Mobil at Parks.

Miscible operators blame the sorry sweep on these two factors:

1. **Mobility ratio** of a miscible drive is poor compared with that of a water flood.

2. **Variations in the rock** properties—such as permeability—from place to place in the reservoir have proved much more critical than first thought.

Operators have seen interaction of these factors create jagged flood fronts with fingering and channeling and relatively quick breakthrough to producing wells.

And there is evidence which suggests, once the LPG or enriched gas breaks through to a producing well, that the sand volume being swept in that vicinity will increase from further gas injection only slightly.

"Unfavorable mobility ratio and sand heterogeneity" were the prime culprits at Seeligson, Humble says. Results were "viscous fingering" and gas channeling. Company engineers also suspect gravity segregation was occurring.

Water slugs helping. The Seeligson project has proved to Humble's satisfaction that the miscible drive needs some added something to improve the sweep.

Its engineers are investigating several possible means of doing this at Seeligson. One method is to shift locations of input wells and continue injecting enriched gas. Others it is considering are injection simultaneously of either dry gas and water or enriched gas and water.

Atlantic already has evidence at two West Texas projects that injection of alternate slugs of water and dry gas help considerably.

One is in operation on the company's 1,200-acre H. T. Boyd lease in Slaughter field. The other is a huge 13,000-acre unitized project which it operates in University Block 9 Wolfcamp field in Andrews County.

Alternate slugs of water and gas following the gas phase were planned from the start at both projects, but were brought into play earlier than anticipated because of premature LPG and gas breakthrough.

At Block 9, propane from input wells around the field perimeter broke through to the first line of producing wells very quickly. And gas-oil ratios at a couple of these producing wells jumped to nearly 100,000:1.

Atlantic switched quickly from gas injection to the water-and-gas-slugging technique in four critical input wells—injecting a few thousand barrels of water, then gas, then more water.

It took only two to three such cycles to produce startling results in the offending first-line producers. After total injection of only about 10,000 bbl. of water, oil production at one of the worst performers climbed from only about 5 bbl. daily to 200 bbl. a day. Meanwhile, the well's GOR fell from 100,000:1 down to a nominal 1,200:1.

Use of the technique in the Slaughter project had the same beneficial effect in a poor-performance area at the south end of the lease.

3. Engineering needs

Its experience to date suggests to Atlantic that even more exhaustive engineering is a must if an operator is to get the most from a miscible drive.

Its engineers feel permeability stratification is largely to blame for fast breakthrough in most projects.

Detective work at Slaughter uncovered a pancake-like layer of high permeability in the San Andres pay in the south end of the field as the cause of the early trouble there.

But permeability differences need not be this sharp. The quick breakthrough at Block 9 came despite a great amount of work put into tracer, insoflow, and injectivity-profile studies which found no severe stratification.

This has convinced Atlantic engineers that permeability averaging just won't work when dealing with adverse mobility ratios, even when there is no severe stratification.

Still many unknowns. Miscible flooders have learned a lot in the past few years. But there are many vital operational points which remain hazy and in dispute.

There is, for instance, still wide disagreement over the size of LPG slug required in the slug drive. More now, in fact, than 5 years ago. Opinions, of which there are almost

as many as there are miscible operators, range all the way from 2% of hydrogen pore space to as high as 25%. Most, however, fall between 3 and 8%. Even this is an extremely wide range when dealing with large expensive volumes of LPG.

And there is some disagreement on why volumetric sweep efficiency has been so poor. Some engineers play down the role of permeability variation, insisting that—due to the adverse mobility ratio—poor sweep would occur even with perfectly uniform permeability.

Unfortunately, most of what has been learned of the miscible process shows it will cost operators more to run, rather than less, and recover less oil than they had first thought.

Journal interviews, however, indicate that miscible operators won't abandon the method for wide future application unless economically forced to it by insufficient allowables. The reason is simple enough. Getting even 10 to 15% more of original in-place oil than a water flood would usually mean a percentage gain in recovery from a pool of at least 20% and perhaps as high as 50% in some cases.

And, widely applied, it would mean adding billions of barrels to U. S. oil reserves.

A recent study by a major company concludes that use of the propane-slug method—where it could be applied in existing fields—could add 19 billion barrels to the nation's oil reserves. This amount is almost equal to one-third of all the oil which has been produced in the U. S.

With oil getting harder to find, you don't snort at figures like these.

Alberta production will hit new high this month

ALBERTA'S crude-oil and condensate allowable for December is a record 509,608 bbl. daily.

The province's Oil and Gas Conservation Board says the higher rate reflects increased market demand from British Columbia, the Prairie provinces, and the U. S. Midwest.

December's daily average is 5% above November and 47% higher than the December 1960 allowable.

Today's markets: more war

Gulftane's spread has brought price wars, but they're slower to start and less violent than in the early tests.

BATTLE lines now are becoming clearer as oil marketers over most of the nation try to find a strategy to keep Gulftane from taking away their gasoline business.

Retail gasoline prices still are unsettled. They form a crazy-quilt pattern. But for the most part they are down—more so in areas where Gulf Oil Corp. has introduced its new subregular.

In general, this is the market picture:

- **Gulf is spreading** Gulftane into new areas of the Midwest, South, and Southwest. The company definitely is going all the way in introducing its economy regular into all areas where it markets.
- **Lower gasoline prices** are resulting, but the reaction is less violent and not quite so quick as in previous markets where Gulf was more or less testing out the idea.
- **Other majors** are now adopting a defensive price position.

Rather than fighting Gulftane on the nose, they are pricing their regular 1 cent above Gulftane, riding the price up or down on that margin. At first the majors met Gulftane in price with their higher quality regulars.

Tenneco has matched Gulftane in Houston with an economy regular. Others are in a position to do the same if Gulftane proves a big winner.

- **Independents** in some of the newer areas haven't been so quick to start cutting when Gulftane came in priced even with them. The cuts when they came also have not gone so deep as in earlier price fights.

The independents realize that Gulftane is aimed at slicing away their gallonage, and for the most part they are trying to keep a 1 or 2-cent margin between their regulars and Gulftane. But Gulf's sticking with them on price has led to some ridiculously low price levels.

- **New fears** of what the future holds for the industry are arising from the unsettled conditions. Among them: The independents will be driven out of business. Price of crude oil eventually will be slashed if gasoline price wars continue. Government control is on its way. The marketing turmoil will do untold damage to the industry's public image.

1. Market picture

Many executives predict gasoline markets will be unstable for 6 months to a year.

Most are convinced now that Gulf is committed to giving Gulftane a real fling. The moves and countermoves accompanying its introduction thus will keep prices stirred up until acceptable new patterns emerge.

But current price reactions are not so sharp as expected.

When Gulftane came to Toledo, Detroit, Flint, Indianapolis, Charlotte, and San Antonio, the price reaction was violent.

Gulftane started out meeting the independents' prices. In some cases the independents cut 1 or 2 cents, Gulftane met them, and the majors followed the continuing slide.

In another version, the independents stayed hitched on price, but the majors cut their regular to stay even with Gulftane. This sent price of major regular gasoline on a toboggan under independents' prices.

There is less of this in new areas where Gulftane came last week. The majors have kept their prices about 1 cent above Gulftane. This let prices be set by the reaction of independents to Gulftane. And this has been mixed.

For example, there was a 10-cent drop to 18.9 at Bradentown, Fla., while the price was a near-normal 31.9 cents at Natchez, Miss. Gulftane came in at levels of 26.9 at Texarkana, 27.9 at Little Rock, 20.9 at Harlingen in the Texas Rio Grande Valley, 26.9 at Corpus Christi, 21.9 at Dallas and Fort Worth, and 27.9 at New Orleans.

In New Jersey, one of the last bastions of fair trade, Gulftane came in even with private brands or under them by 1 or 2 cents.

The fair trade major regular price in New Jersey is 29.9 cents with

than peace, but less fatal than expected

most private brands at 27.9 but some at 26.9 and 25.9. Gulftane came in at 27.9 generally with a few spots getting prices of 25.9 and 26.9 even where competing private-brand stations were selling higher. Marketers fear a bloody price war is in the making which will wipe out fair trading.

Another possible market powder keg is the southeastern states. Gulftane is another explosive element added to a scrap already developing between California Standard and Humble over Kentucky Standard's business (OGJ, June 19, p. 64).

Gulf, Humble, and Kyso all market three grades in the Southeast—but each slightly different. If the competition gets rough enough, all three could settle down to the same level as Gulftane, giving other majors and independents a hard time.

2. Majors' strategy

Executives of most major companies are following a policy of restraint. They don't want to feed a volatile price situation.

The majors want to protect their markets from being raided by Gulftane, yet they want time to see the consumer reaction to Gulf's moves before they change any of their own marketing methods.

That's why the majors are pegging price of their regular at 1 cent above Gulftane. How long this pricing policy will stick hinges on developments.

Several majors have discovered that when they cut their regular to meet Gulftane their gallonage shot up substantially. But when they moved back to 1 cent above Gulftane, the volume dipped to pre-Gulftane levels. Many thus feel that no major can let Gulf indefinitely undersell them by 1 cent and hope to maintain its business.

Price signs seem to be calling the turn completely right now as far as the consumer is concerned. The majors know this, but they also are concerned with pricing their products to yield a profit.

Many view Gulftane as another form of price cutting. They estimate the cost of manufacturing Gulftane is only a fraction of a cent less than that of Gulf regular, yet it brings 2 cents less at the pump. The same set of economics would prevail if they started marketing a similar third grade.

They can switch. It's a safe bet, however, that if Gulftane picks up big volume the other majors will put in a competing grade or again meet Gulftane on price.

The cost of a third grade would be substantial for two-grade marketers but not as much as many believe. Most majors within the last 5 or 10 years have provided spare tankage and equipment for a possible third grade in their new service-station construction. They were looking ahead to a possible super-premium or a turbine-engine fuel. These systems could be used at little additional cost.

Distribution would then be the big problem and cost, but if prospects of higher gallonage were at stake the cost might be worth paying.

At least some majors may be tempted to test a subregular at their newer stations in metropolitan centers before introducing it to older stations where equipment costs would be high.

3. Independents' reaction

Many of the smaller independent operators are singing the blues.

"We just hope we can survive. We can't fight Gulf," said the executive of a Houston independent with about 40 stations. "If prices stay at 22.9 indefinitely, we'll be out of business. Most independents are in our position."

Another said, "Gulftane will definitely cut into our volume. And I don't know what we can do about it."

The executive of an independent marketing trade group in Texas said privately he was telling his members to expect a 50% loss of their volume to the majors.

Some of the larger independents have elected to fight Gulftane on price while the smaller ones have just followed, this official reported. They have gone down to cost and stayed there with Gulftane meeting their price.

Other independents say only a few larger marketers with supply contracts with majors give them a measure of guaranteed margins can survive this kind of pricing.

One independent executive sees the Gulftane move as part of an attempt by majors to eliminate the independent refiner and marketer.

He said in the past majors have bought out jobbers served by small

SPREAD of Gulftane has upset prices in areas where it is being sold.

COMPETITION for Gulftane in the Houston area is Tenneco's "special." The company doesn't say whether this gas is a subregular or a cut-price regular.

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IT'S TIME to order your free copy of the index of articles which appeared in the Journal during 1961. It will be ready for distribution early in January.

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refiners, have started selling products to independent marketers, have solicited commercial accounts, and now have started meeting the independents on price.

This official said that the major, with national advertising and promotional appeal, can take business away from the independent retailer on an equal-price basis. The independent needs at least a 2-cent margin to stay healthy because he'll lose business to the major even on the 1-cent spread.

Outlook for independents. The concensus among independents seems to be they have about four courses of action:

Sell out to a major.

Start marketing and pricing like a major.

Revert to their pioneer ways of doing business.

Seek help through legislation.

One independent predicted the mass bankruptcies of independents won't occur overnight. He said they will come gradually after other majors introduce subregulars to match Gulftane and after the independent discovers that all other gimmicks won't replace his low-price attraction for customers.

The idea of selling to a major isn't new—majors have been buying out independents right and left in the past few years. The new battles may speed this up.

A handful of large independents, some of whom are almost major status, probably will continue to market like majors, but their price advantage will be shaved or eliminated. Many marketers feel that the smaller independent will have to change his ways—go back to less expensive stations with gravel or shell driveways, a lower quality product, economies all around to justify price differential.

One independent official estimated this means the independent can expect a potential of 5 or 6% of the gasoline market compared with about 20% being enjoyed currently.

One major executive observed that the independent should not insist on making price his chief sales point. In other lines of retail business, the independent isn't cheaper than the chains. The independent grocer, for instance, sells personal service and doesn't insist on lower prices.

Since World War II, this official noted, the independent gasoline marketer has been getting the same quality gasoline as the majors, has moved into better neighborhoods, has good stations on paved driveways, gives away coupons, advertises, and accepts credit cards. He still wants a price differential to get volume.

This generally sums up the feeling of most majors that independents have been getting an increasing share of the gasoline business by a price differential to which they are not entitled. They disagree only in approach. And if Gulf with its subregular, or Humble with a middle regular, or Sun with its blends proves it has the answer to attracting more customers, it's a good bet other majors will adopt the idea.

4. Danger ahead

Some dangers. The marketing battles are almost certain to heighten the threat of more government controls on the oil industry.

Independent marketing groups have already decided to seek sanctuary in national legislation. The Society of Independent Gasoline Marketers of America (Sigma) has adopted a resolution to seek divorcement of crude-oil production from manufacturing or marketing. Calvin Houghland, Nashville marketer, has called a board meeting for December 15 in New Orleans to plan further strategy.

The National Oil Jobbers Council last month asked for a congressional investigation to determine if the depletion allowance is being used by integrated oil companies to finance price wars (OGJ, Nov. 20, p. 142).

The Independent Refiners Association of America also plans to be more active in Washington next session. IRAA President M. H. Robineau said his group will present the independent viewpoint before congressional hearings or government agencies and will seek legislation helping the independents in their fight for survival.

Most oil men fear the current marketing battles are bound to result in some substantial retaliatory action.

"No one goes out of business gracefully," is the way one executive put it.

Arizona adopts new field rules again

ARIZONA has adopted new oil and gas conservation rules for the second time in 2 years.

The latest regulations, however, still are not complete. They lack provisions dealing with proration and allocation of production. But the Arizona Oil and Gas Conservation Commission plans a closed hearing within 60 days to fill this gap.

The field regulations adopted last week by the commission generally coincide with rules endorsed by the Interstate Oil Compact Commission and with rules adopted by the commission in 1959. The 1959 rules were stricken by a state attorney general's ruling that proper notice was not given prior to their adoption.

The new regulations deal with drilling and completions, abandonment and plugging of wells, oil and gas production operating practices, injection to increase recovery, purchasing and transporting, refining, and reports.

The rules for prorating and allo-

cating production between wells and fields also are expected to coincide with the 1959 set. These rules based proration heavily on reserves with a formula based on an "economic" allowance and an "acreage" allowance.

FTC examiner knocks out 'good faith' defense in American Oil case

A FEDERAL Trade Commission examiner has ruled that American Oil Co. acted illegally when it cut prices to dealers in one area without a similar reduction to its dealers in a nearby area.

American said it made the cuts in self defense after a price war broke out and that its action was taken in good faith to meet the price of competitors.

The case involves a price war in Smyrna, Ga., in late 1958. The record shows the war started when a Shell Oil Co. station cut its prices to meet the prices of a private-brand station across the street. The war spread to other stations in the Smyrna area but not to Marietta, 4 miles away.

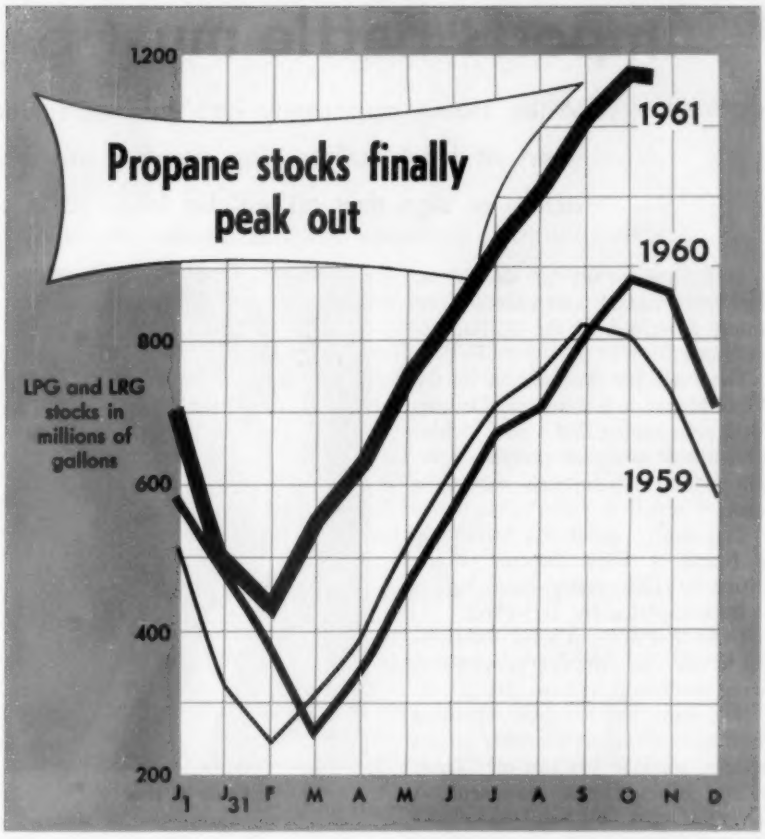
The FTC examiner, Edgar Buttle, ruled that dealers in Marietta were discriminated against and that competitive injury resulted.

In ruling out American's defense of "good faith" action to meet competition, the examiner said the price reductions by American were to meet its customer's competition and not competition at its own level.

Also, the examiner ruled, good faith defense must be based on specific case-by-case price cuts and not on a general cut to all customers in a given area.

The examiner also maintained that American must have known that the prices it was meeting were discriminatory and therefore illegal. In other words, according to the examiner, American should have recognized that Shell's initial price cut was questionable and therefore should not have met it.

American attorneys said they would appeal. They said the examiner should have followed a court ruling in a recent Sun Oil case in which the court said that Sun had a right to meet competitive prices in good faith.



LPG still needs an icy winter

FOR the first time since last February, propane stocks have halted their dizzy climb and started dropping.

Last summer the stocks reached record levels. And every month since July, the new records have been set. The break finally came in November.

The decrease was about 3 million gallons for the first 15 days of the month, according to semimonthly report of the American Petroleum Institute.

Even so, propane stocks still stand 311 million gallons higher than for the same period last year.

Suppliers, as a result, need a very cold winter to encourage heavy sales or they will have to dig more storage caverns to handle the overflow next summer.

The LPG industry's oversupply problem actually started last March. Instead of continuing a wintertime drop, propane stocks headed upward sharply. They jumped about 300 million gallons over the total for the same month of last year.

Since the March debacle, propane stocks have followed the seasonal pattern. The gains over 1960 were 278 million gallons in July, 313 million at the end of August and 311 million in November.

The statistics thus show that propane stocks would be in fairly good shape if it had not been for the March buildup. The total buildup since the end of March this year has been 643 million gallons compared with 592 million last year, a gain of only 51 million gallons.

Other aspects of the stock picture:

Additions to underground storage—616 million gallons this year compared with 567 million last year.

Aboveground stocks at refineries—up 5 million gallons compared with 1 million last year.

Other terminal and pipeline stocks, excluding material underground—up 20 million gallons this year compared with 25 million last year.

Imports battle must be fought all over

White House apparently isn't sold on current program. But it will be mid-year, at least, before any changes are made. Some interpret holdup of action as sign that oil will be involved in coming fight over trade policy.

THE Government has decided to start from scratch and take a completely new look at the oil-imports program.

The stage for this was set by the White House in a statement December 2 announcing that a new, "comprehensive" study of petroleum requirements and supplies would be made.

The study, under the leadership of Frank B. Ellis, director of the Office of Emergency Planning, is to be completed by mid-1962.

Until that time, at least, the present crude - oil - import program is being continued without change.

The immediate outlook regarding residual-fuel-import controls is less certain, since it was not mentioned in the White House statement. A study of resid has been under way at OEP for several months, but no decision has been indicated.

Although the brief White House announcement left much unsaid, it did clearly indicate that the administration is not fully satisfied with the present program nor with the proposed revisions offered by the Department of Interior.

It said that the study group under Ellis was being asked to make recommendations on "alternative means of achieving our security objectives and providing a basis for increasing our strength to compete in the free world."

Thus the door was left open to consideration of an entirely new approach, including the possible use of subsidies or tax benefits rather than direct limitations on imports themselves.

It was also evident that oil will be considered in relation to the nation's over-all economic picture and trade policy. For example, the statement specified that "the study will take into account not only the welfare of the domestic petroleum industries but also the need to promote the nation's economic growth in the face of rapid technological and world changes."

Frank B. Ellis
. . . heads government oil study.

The statement concluded: "Since the study will include a review of the mandatory oil-import program, it will provide a basis for the consideration of any changes in the existing program that may be necessary. In the meantime, allocations of oil-import quotas will continue to be made under the existing proclamation."

Tariff-fight role? Many Washington oil observers feel the White House action means that oil controls will be deeply involved in the general fight shaping up over tariffs and trade policies generally.

The administration plans to seek a broad liberalization of trade agreements when the Trade Agreements Act comes up for renewal in Congress next year.

Strong opposition to such a move is already developing, so the outlook is that this issue will be the most heated one in Congress in the months ahead.

In view of this, there was some speculation that the White House may have deliberately postponed a decision on oil-import controls to give further bargaining room.

There were also reports that the State Department and others had argued against Interior's proposed tightening of import restrictions on the grounds that this would be directly in conflict with the administration's over-all aim to ease trade restrictions.

At any rate, the long-range outlook for oil-import controls is more uncertain now than at any time since the control program was first launched on a voluntary basis.

Such uncertainty obviously will cause all factions to press their viewpoints anew, both at OEP and in Congress, so that oil controls will continue to be a highly controversial issue.

The oil study. There has been no decision yet on the exact outline of the study OEP will make.

It is possible that public hearings may be held, but this is not certain. However, it is likely that interested parties will be given some opportunity to present their views.

A spokesman for OEP said the study would be conducted by an interdepartmental committee, made up of representatives from Interior, State, Commerce, Defense, Justice, and others "normally" involved in oil questions.

Cabinet members will not be directly involved in the study, although they may participate in decision-making in the final stages.

Some of the information for the study may come from two other sources. One is a long-range, supply-demand project that Interior's Office of Oil and Gas has been working on for 3 years. The other is world-wide oil data that will be gathered by a foreign - petroleum - supply subcommittee now in the process of being activated.

Ellis mentioned both of these in recent testimony before the House Small Business subcommittee headed by Rep. Tom Steed (D.-Okla.)

At that time, Ellis said the OOG report would be available "early

again

next year" and that data collected by the FPSC subcommittee would be compiled by midyear.

He indicated that each would help provide a basis for decisions on oil-import controls.

Reaction. The White House announcement set off a flurry of comment within the industry.

The Independent Petroleum Association of America said President Kennedy's decision to postpone action was a threat to both national security and economic growth.

IPAA promptly called an emergency meeting of its import-policy committee "to determine necessary steps and courses of action to correct this intolerable situation." The meeting will be held in Dallas Tuesday.

Top officials of the Texas Independent Producers and Royalty Owners Association expressed disappointment over the delay. However, TIPRO President J. F. West indicated the association feels that the new study gives producers an opportunity to press for a more satisfactory program than Interior had proposed.

An official of the National Coal Policy Conference commended President Kennedy's action.

He said that although the White House statement did not mention residual-fuel-oil controls, "we have since been assured by official sources that the decision applies also to residual and that no substantive changes in that program are planned until completion of the comprehensive study by the Executive Department."

Interior Department oil officials had no comment on any phase of the White House announcement. "What is there for us to say," one asked. "We just got a licking."

Interior's proposed revisions, which would have reduced the flow of crude oil about 50,000 bbl. daily and would have made other changes in the mechanics of the program, ran into stiff competition from representatives of other departments.

This opposition apparently helped bring about the decision to delay any changes until a new evaluation of the situation could be made.

WATCHING WASHINGTON

with Clyde La Motte

White House action underlines lack of an oil policy

"THE present administration has not yet developed any clear-cut long-range policy regarding oil-import regulations."—(OGJ, Nov. 27, p. 64).

The only revision needed in that conclusion, in view of the President's December announcement that an oil study would be made, is that the words "clear-cut" and "long-range" can be eliminated. The administration has no oil policy, period.

Furthermore, it seems obvious that the President has decided not to rely on Interior Department to shape one. In the end, politics may become the biggest factor of all as the administration fights for congressional votes for a liberalized trade policy.

This time the administration wasn't hunting headlines

THE MANNER in which the White House statement on oil imports was released was as puzzling as some of the gobbledegook wording of the release.

Copies were distributed to White House reporters who were returning by train to Washington from the Army-Navy football game in Philadelphia. There was no briefing session nor explanation. Nor was the oil press notified at all.

Most of the reporters on the train, not familiar with the oil-imports situation, paid scant attention to the release. As a result, many newspapers throughout the country didn't have the story at all Sunday morning while others carried only a brief wire service dispatch.

Whether or not the White House deliberately tried to "hide" the story, that was the result it obtained.

O'Connor backs Swidler on producer control, area pricing

NOTE that Federal Power Commissioner Lawrence J. O'Connor, Jr., is in agreement with Chairman Joseph C. Swidler that continued regulation of natural-gas producers is necessary to protect the public interest.

O'Connor said so in a recent speech in Oklahoma, his first major address since taking office.

Since Commissioner Howard Morgan has also expressed a similar view, it is obvious that a majority of the present commission is convinced that controls must remain. Thus there is no possibility that this commission would support a move to exempt producers from direct control.

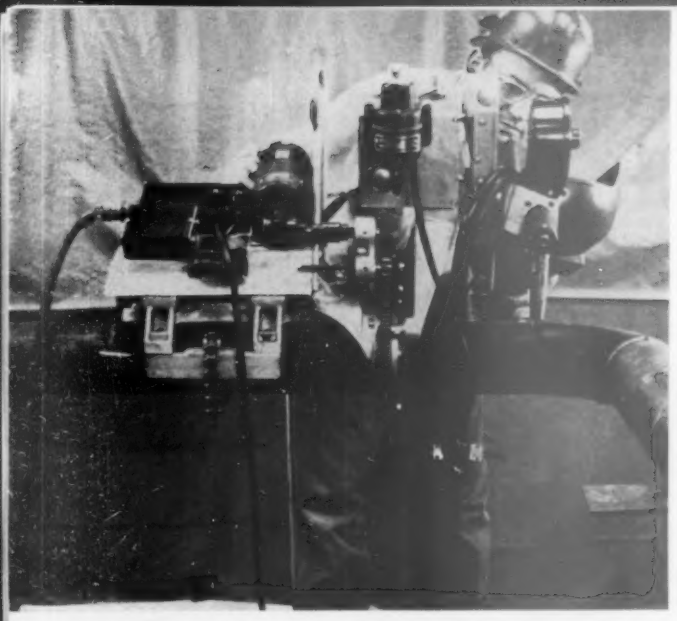
O'Connor also agreed with Swidler that area-pricing offers the best approach to regulation, and that such prices must be a ceiling, not a floor.

Court upholds FPC's right to try area procedure

AREA-PRICING for natural-gas producers has gained further momentum as a result of a court ruling upholding the commission's legal right to try that approach.

A Federal Circuit Court of Appeals in Washington said that the commission, in abandoning the individual cost-of-service approach "has abandoned a method it finds to be unworkable and foolish in favor of a method it deems to be workable and just and reasonable."

If the area approach fails to protect consumers, the court said, "the way is still open for them to challenge the results."



New automatic-welding machine handles small-diameter jobs

A LIGHTWEIGHT, automatic welding machine for small-diameter pipe is making its bow. It was developed by the Linde Co., and will be demonstrated publicly for the first time this week in Houston.

The welder is both light and compact. It weighs approximately 100 lb. and can be handled by a single operator. It is known as the Linde Short Arc Welder and is capable of welding pipe from 3 to 10 in. in diameter.

It uses a standard Sigmette torch. The pipe is beveled to 37½° with a ☆-in. nose. Pipe is tacked first by the Heliarc process at the 12 and 6 o'clock positions. Welds are made from the 12 o'clock down to the 6 o'clock position for all passes.

The unit makes root, filler, and cover passes. Its travel speed is from 7 to 10 in. per minute.

Alberta-U.S. condensate line approved

PIPELINE facilities for the export of up to 31,000 bbl. daily of condensate from Alberta to Rocky Mountain and midwestern markets in the U. S. were approved last week by Canada's National Energy Board.

Provincial approval of the project was granted last June. A presidential permit still must be obtained for the border-crossing facilities.

Only the border-crossing facilities—half a mile of 8-in. pipe—had to be approved by the board. But the project involves 11 miles of 6-in. pipe from the Waterton gas-processing plant to the Pincher Creek plant, a pump station at Pincher Creek, and 29.9 miles of 8-in. from there to the border near Cut Bank, Mont.

These facilities will be owned and operated by Hudson's Bay Oil & Gas Co., Ltd., an affiliate of Continental Oil Co. The border-crossing line is owned by Aurora Pipe Line Co., a wholly owned subsidiary of Hudson's Bay. At the border the line will connect with Continental Pipe Line and thence to Rocky Mountain and midwestern markets.

Initial throughput of the system is expected to be 11,000 bbl. daily of 58.4° condensate produced from the Waterton and Pincher Creek fields. With the construction of a plant in the nearby Lookout Butte area, an additional 5,000 bbl. daily would become available in 1963.

Continental has agreed to purchase 10,000 bbl. daily from Shell Oil Co. of Canada, Ltd., at Waterton and British American Oil Co., Ltd., at Pincher Creek, for its own use or sale in the Rockies. Any volumes in excess of this level might be transported through connecting lines as far as Wood River, Ill., according to testimony at the NEB hearing.

Exports above 16,000 bbl. daily would depend on development of additional reserves in the area. However, the facilities approved have a design capacity of 31,000 bbl. daily into an area of the U. S. which will be opened for the first time to Canadian oil in substantial volumes.

Military's set-aside awards to refiners must be revised

A LEGAL OPINION by the comptroller general is forcing the military to eliminate "floating" set-asides for refiners classified as small business firms.

In the future, Military Petroleum Supply Agency apparently will be required to specify set-asides for specific delivery points rather than on a nationwide basis.

This will tend to reduce the opportunity of an individual small refinery to get a set-aside award. Also, if the set-aside for a particular area is not picked up by a small refiner, it cannot now be transferred to another area.

Under the "floating" plan MPSA was using, it was able to set aside a specific amount of a total fuel requirement and then make the award wherever feasible without regard to any ceiling on quantity for a particular area.

Blowby devices will be installed on all 1963 cars and trucks

THE automobile industry has agreed to install blowby devices to eliminate crankcase fumes on all gasoline-powered cars and trucks beginning with 1963 models.

Directors of the Automobile Manufacturers Association, in recommending the action to members, said the crankcase blowby equipment eliminates up to 40% of all air-polluting hydrocarbon emissions from autos. California authorities estimate it stops only 25%. Emissions through the exhaust system are not affected.

Blowby devices have been installed on all cars built for sale in California since the fall of 1960. They collect gases which are blown past engine pistons and return them to the engine for combustion.

Your choice of the most effective antiknock and an optimum balance between processing and antiknock compounds are more important than ever in today's gasoline market.

A different antiknock—a different refinery balance—or a combination of both—may give you a more competitive fuel at the same or lower cost.

Evaluation of octane-improvement methods and costs has played a major part in Ethyl's activities for 38 years. Our technologists—including linear-programming specialists—will be glad to assist you in determining the best allocation of components and optimum antiknock concentration.

The experience and data from our continuing lead alkyl evaluation program can provide unmatched assistance in selecting the most effective "Ethyl" antiknock from the wide range now available. Just call your Ethyl Representative.

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States told to modernize regulations

Failure to keep laws and rules up to date with advancing technology is making oil too costly, Kelly tells IOCC. And, he says, he's concerned that the industry seems unable to solve its problems.

A BLUNT admonition to producing states to modernize their conservation and regulatory practices so as to make United States oil competitive with imports was given the Interstate Oil Compact Commission last week by John M. Kelly, Assistant Secretary of the Interior.

Despite all that IOCC has done to improve producing practices, much more remains to be done in wider application of technological knowledge, he said.

While he gave no hint of federal control, many listeners read an implication of an "or else" into his warning that the states should get on the ball. He mentioned specifically unitization, pressure maintenance, and wide well spacing.

Other speakers, too, stressed the advantages of these and other conservation measures. All in all, the program of the Denver meeting—one of the strongest IOCC has had in several years—might be summarized as an effort to get the compact back on the track of earnestly espousing continual modernization of the conservation practices of all states.

Kelly's talk. John Kelly, who went to Government from the oil business, said that problems are nothing new, but "the new element, and that which gives rise to concern, is the apparent inability of the industry to develop workable solutions to the difficulties with which it is confronted."

The most immediate problem facing the domestic industry, Kelly said, is to become competitive with oil produced abroad, and one of the most important means of doing this is the application of technology to petroleum production practices. "I think we all agree that we know better than we do in petroleum production practices."

Wider use of unit operation of oil fields and early application of pressure-maintenance practices would help increase the industry's revenues and decrease its costs, Kelly said, but he bore down hardest on well spacing.

John M. Kelly

"Every time a well is drilled at an interval less than that indicated by a careful study of the mechanics of the reservoir, an economic cost is incurred which must be paid for out of some subsequent production of oil. This one factor of more or less uncontrolled well spacing in many states has been a principal element in making portions of our domestic production uneconomic.

"This is an outstanding example of the lag between our technical knowledge and the application of this knowledge. The compact has been a great force in reducing this lag. This, it seems to me, is its greatest challenge and its greatest promise.

"Obviously, one of the major remaining tasks is to convince the states that some of their existing statutes and practices are obsolete or deficient and must be improved."

Proration urged. Proration to market demand also came in for open discussion quite apart from action on the "equality of opportunity" committee.

An exceptionally strong endorsement came from Frank M. Porter, president of the API. "There are those who maintain that oil should be produced in total disregard of market demand," he said. "But they are mistaken if they think ignoring market demand would turn every oil reservoir into a year-round bargain basement. No state has a vested right in any market.

"Demand for oil happens to be

IOCC to collect

THE controversial elements of the study of production and reserves by member states have been removed by the Interstate Oil Compact Commission.

Instead, the organization's executive committee has been instructed to obtain, through the governors of the member states, factual reports to be published for information only.

For each state the statistics will show annual production of gas and liquid hydrocarbons, increase or decrease in reserves, and "production by and purchases from others by each purchasing company and affiliates in the state for each month."

The special subcommittee on "equality of opportunity to produce" was terminated after discussion in the regulatory practices committee and the executive committee.

The matter of the various states' "fair share" of the domestic market has been an issue before IOCC meetings for the past 3 or 4 years. Several special committees have begun studies, only to run into strong opposition from Rocky Mountain and other states.

At the Denver meeting last week the subcommittee itself unanimously recommended that it be reorganized and given a more specific and more

quite inelastic. Excess oil would pile up on us and some kind of costly storage would have to be provided and the extra expense added to the price oil men would have to charge. This kind of anarchy would close down many wells and discourage the hunt for others.

"Intelligent conservation practices—including due regard for market demand—benefit the consumer."

Another boost for proration came from Alvin C. Hope, president of IPAA. After chastising refiners and marketers for glutting, he said:

"I would like to say a few words to my independent producer friends about the dangers of wide-open production in these times. To continue to force oil into a market that is saturated is a most dangerous procedure. To do this where there is no ratable take is to invite having no market. I also say this can well lead to that critical point of completely breaking the market."

Air Force to require anti-icer in JP-4

THE AIR FORCE has announced the adoption of an anti-icing additive for JP-4 fuel.

The additive was developed by Phillips Petroleum Co. as a part of an extensive research - and - testing program instituted by the Air Force in conjunction with commercial firms.

The Air Force said the additive is being required to prevent loss of aircraft due to fuel-system icing.

The Air Force will require that the additive be blended into the JP-4 fuel at refineries on the basis of 1 gal. of additive to 1,000 gal. of JP-4.

Since the Air Force uses more than 100 million barrels of JP-4 annually, the use of the new additive will be extensive.

The additive will be required at certain selected locations as soon as possible and will be mandatory for most Air Force locations as of April 1, 1962.

The additive, which must conform to specification to Mil-I-27686 (USAF) is being incorporated as a requirement for all bulk deliveries of military specifications Mil-J-5624E JP-4 fuel.

Contractors servicing contractor-owned JP-4 fuel into USAF aircraft under the terms of "into-plane" contracts will not be required to provide additive product unless Air Force aircraft are permanently assigned at the location.

No requirement for the additive has been made for JP-5, JP-6, or specification Mil-J-25524A fuels.

data on output, reserves in member states

restricted set of instructions. However, the full committee rejected this, and passed the whole subject to the executive committee.

What's involved. The new approach to be taken by the executive committee will be based largely on production and reserves statistics already available, and will include natural gas and gas liquids along with crude.

This is one of the subjects in controversy, since the southwestern states wanted a state-by-state comparison of crude production only, while the Rocky Mountain states insisted that all petroleum fuels be considered.

The third subject to be covered, the practices of crude - purchasing companies, has been a sore spot with many independent producers, particularly in Texas, for some time. Last summer the subcommittee obtained IOCC approval to obtain this information directly from the industry. This decision has now been reversed. It was agreed that figures on volumes produced and purchased by individual companies can and should be obtained only by state officials.

The Denver resolution directs the executive committee to make annual compilations of the information "for such use as individual states may desire to make of same." The resolution also specifies that "no state reporting the information, or the executive committee, will make any recommendation or suggestion regarding the method of determining production by individual sovereign states."

Quotas for states? The specter of federal control setting market quotas for all states loomed large throughout the discussion, but the disagreement came on how to forestall this.

Some said IOCC should do the job, while others said this would simply set the stage for the federals to take over. Some contended the less said about interstate market competition the better, while others argued that continued open discussion with IOCC as the forum would forestall the need for any formal action.

The small nonprorating states pointed out that if their entire production were shut off the benefits to the large southwestern states would be negligible. The prorating states countered that a factual study is necessary to determine whether their own proration systems should be continued or modified.

The final consensus was that each state has its own problem of contending with a market which can easily be oversupplied; that nobody outside the state should tell any state how to deal with this problem or how much of the market it should have; that a limited factual study may do some good; and that any IOCC study should be kept under control and not used for purposes outside the scope of the Interstate Oil Compact.

Edmondson heads IOCC

J. HOWARD EDMONDSON, governor of Oklahoma, last week was elected new chairman of the Interstate Oil Compact Commission.

Indiana's Elmer Hoehn was elected first vice chairman, and New Mexico's A. L. Porter, Jr., was elected second vice chairman. Edmondson's election came on the fourth ballot, after tie votes on the first three.

Where southwestern refinery runs stood in October

HERE are crude-run figures for southwestern states where data are obtainable from regulatory agencies.

Arkansas

(Refinery runs in barrels daily)

Company and location—	October	September	Oct. 1960
American, El Dorado	39,961	38,065	35,088
Lion, El Dorado	34,038	27,207	33,618
Macmillan, Norphlet	3,431	2,805	2,360
Other	7,322	6,145	5,890
Total Arkansas	84,752	74,222	76,956

Louisiana

Cities Service, Lake Charles	175,148	175,345	165,018
Continental, Lake Charles	47,126	50,245	51,598
Humble, Baton Rouge	315,353	266,313	294,950
Ingram, Meraux	16,330	19,328	17,417
Shell, Norco	113,260	113,818	102,684
Tenneco, Chalmette	47,600	46,359	40,876
Other	7,451	7,549	8,151
Total	722,268	678,957	680,694

Mississippi

Paluxy, Yazoo City	(*)	2,212	1,679
Pontiac, Hattiesburg	8,921	15,720	16,123
Southland, Sandersville	6,295	5,421	3,971
Total Mississippi	8,921	23,353	21,773

Texas

American, Texas City	96,004	70,005	122,032
Am. Petrofina:			
Mount Pleasant	17,741	15,905	13,719
Wichita Falls	8,408	8,167	7,079
Atlantic, Port Arthur	63,929	53,975	68,732
Col-Tex, Colorado City	6,582	7,513	7,660
Continental, Wichita Falls	11,376	12,867	12,703
Cosden, Big Spring	27,098	27,763	25,005
Crown Cent., Houston	34,618	31,618	34,596
Delhi-Taylor:			
Corpus Christi	39,979	32,989	38,804
Post Isabel	5,349	4,904	1,458
Eddy, Houston	2,093	1,874	1,972
El Paso, Odessa	14,483	15,616	12,219
Gulf, Port Arthur	196,102	200,748	270,375
Howell, San Antonio	2,391	(*)	2,101
Humble, Baytown	267,431	197,605	273,675
La Gloria, Tyler	17,036	16,676	16,382
Mobil, Beaumont	204,603	170,506	195,454
Phillips:			
Phillips	66,843	67,688	54,826
Sweeny	72,613	58,772	55,534
Plymouth, Texas City	32,881	13,457	21,911
Pontiac, Corpus Christi	50,561	44,734	47,093
Premier:			
Fort Worth	7,606	7,536	7,484
Longview	2,902	2,784	4,358
Pure, Nederland	83,314	61,338	71,946
Shamrock, Sunray	25,108	25,507	24,620
Shell, Houston	124,114	116,303	106,073
Signal, Houston	62,222	55,192	49,498
Sinclair:			
Corpus Christi	17,825	22,141	28,085
Houston	62,222	145,666	108,138
Skelly, Longview	3,646	3,387	3,058
Southwestern, Corpus Christi	42,066	35,546	25,334
Stand. Tex., El Paso	48,266	50,663	46,068
Suntide, Corpus Christi	41,754	39,626	39,027
Texaco:			
Amarillo	14,257	16,357	13,341
El Paso	8,718	2,735	1,466
Port Arthur	278,090	†217,848	†261,293
Port Neches	44,277	39,284	40,837
Texas City, Texas City	21,580	10,316	(‡)
Other	23,691	14,697	20,609
Total Texas	2,228,686	1,920,308	2,134,565

*Not available at press time. †Includes condensate. ‡Not reported.

Processing briefs

Tidewater and Collier started up their new, joint-venture petroleum naphthalene plant at Tidewater's Delaware refinery last week. The multimillion-dollar facility, the second such plant built, has an initial capacity in excess of 100 million pounds per year. The new plant, using the Unidak process developed by Union Oil Co., converts alkyl naphthalenes, basic components of an aromatic refinery by-product, into high-purity naphthalene. Catalytic Construction Co. was the prime contractor.

Vinyl acetate monomer will be produced with new facilities to be built at Monsanto's Texas City plant. Raw materials for the 45-million-pounds-per-year plant will be acetylene produced at Texas City and acetic acid derived from ethylene made at the company's Chocolate Bayou plant now under construction (OGJ, July 24, p. 53). Monsanto will use the vinyl acetate monomer at its plants which make vinyl plastics and emulsions. Completion is scheduled for end of 1962. Scientific Design Co., Inc., is contractor.

A new refinery has been brought on stream at Holyrood, Newfoundland, by Golden Eagle Refining Co. of Canada. The 8,000-bbl.-daily plant will process Venezuelan crude and serve retail outlets in Newfoundland and eastern Canada with a full line of petroleum products. Lundrigan's Construction, Ltd. was the general contractor with Universal Oil Products and Southwestern Engineering handling engineering design for the project.

Capacity has been quadrupled at Texas Alkyls' La Porte, Tex., plant. Capacity is now 8 to 10 million pounds yearly of aluminum alkyls such as triethyl aluminum and triisibutyl aluminum. These materials are used as catalysts to make various plastics and other chemicals.

Texas American Oil Corp. has acquired control of Detectogas Instruments, Inc., of Houston, Tex. Detectogas produces and markets a new instrument, operating on an air density principle, for detecting and correcting preexplosive accumulation of gases in refineries. pipeline stations, missile pads, public buildings, and other places that gas may be used.

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California seeks gas-price controls

State agency claims public interest would be served by wellhead-price controls. Opponents charge this would hurt California producers and could be springboard for control of oil production, out-of-state gas flow.

ANY company connected with the gas business in California, whether it be a local, Mid-Continent, or Canadian producer, may be riding for a fall—and a hard one.

The staff of the state's Public Utilities Commission last week outlined its plan to regulate the wellhead price of gas produced in California. Aim of the program is to stop the rise in the field price of California gas and to throttle down the flow of out-of-state gas into California.

The proposal would give PUC power to regulate the price of gas sold both for resale or directly to the consumer. The staff urged the commission to adopt its plan and present legislation to the lawmakers in Sacramento.

California producers would be hardest hit by the PUC plan, but it also could reach outside the state's borders. The staff argued that the controls are needed in order to prevent discrimination in favor of out-of-state gas over local supply. About 75% of California's gas supply comes from Texas, Oklahoma, and New Mexico. And the first Canadian gas is due within a matter of weeks.

Franklin G. Campbell, PUC staff counsel, listed four "benefits" which would result from the state's controlling all gas sales:

1. Actual costs would be known, enabling the commission to prevent "unwarranted price increases." Producers, he said, would get a fair and reasonable price for their gas.

2. Reserves would be revealed, permitting the state to "evaluate supply against demand." This would make future planning "more realistic" and conserve gas. Too, he said, reserve information on California fields would insure a market for local gas supplies and prevent discrimination against local producers.

3. Controls would prevent "unwarranted price competition among utilities and industries and municipalities, which tends unjustly to raise the price of gas."

4. The state also could prevent any duplication of facilities if it controls gas prices.

FPC's experience. Campbell made it plain that the problem the Federal Power Commission is having in attempting to regulate gas prices does not dampen his staff's enthusiasm about its proposal.

He said the FPC not only doesn't want to regulate prices, but tried to avoid gas controls until forced into the issue by the Supreme Court ruling in the Phillips case. He implied this is not the case as far as PUC is concerned.

Campbell also said the Natural Gas Act hampers gas regulation on a nationwide basis since it permits rate increases to go into effect "automatically a short time after filing," instead of setting up "a procedure where there is a presumption that present rates are fair and reasonable and no increases are granted until the applicant proves that it is entitled to them."

Campbell said California could control wellhead prices either by the cost-of-service method or with area prices. All new sales would be covered. Existing contracts would be submitted at the initial price, but would be subject to change if a hearing justified a change.

Price controls, he said, would not present any "insurmountable problems."

Opposition. Oil men opposing PUC's controls program picked up some surprise support from Rep. James Roosevelt (D.-Calif.), generally considered an oil-industry critic.

"The best way to insure the continued development of natural-gas reserves in California is to permit free enterprise and to avoid strangling a growth industry so badly needed in this state," Roosevelt declared.

State controls, he said, would subsidize out-of-state producers and would lead to more gas-transmission lines "bringing gas from other areas into this state at increased costs to the domestic consumer."

Stark Fox of the Oil Producers Agency of California said the control program could lead to control of producing rates, thus forcing PUC into the "untenable position" of controlling oil production.

"We say 'untenable position' because the people of this state do not believe that state control of oil production is in their interest," Fox said.

He pointed out that three efforts to control oil production have been defeated at the polls. The most recent was the ill-fated Proposition 4, defeated by a wide margin in 1956.

Fox admitted California gas prices have increased in recent years, but said it is conceivable prices could double and still have only an "insignificant" effect on the rate base of a gas utility since the majority

Pipeline briefs

Contracts to build Dixie Pipeline stations have been let by Service Pipe Line, which is supervising Dixie construction. Stations will be built at Mont Belvieu, Tex., and at Lake Charles, Breaux Bridge, and Baton Rouge, La., by Trend Construction; at Hattiesburg, Miss., and Demopolis and Opelika, Ga., by Anco Manufacturing & Supply; and at Griffin and Norwood, Ga., and Columbia, S. C., by Lea County Construction. The electric, fully automatic stations will be remotely controlled.

A net loss of $2,571,345 was reported by Mid-America Pipeline for the first 9 months of 1961. Gross income was $4,595,556 and operating expenses were $7,166,901.

of the gas sold in California is imported.

He said that while the price of gas has increased 5.57 cents per M.c.f. during the last 5 years, the competition to sell this gas has increased from 87 producers to 119 producers.

Other testimony. Turner H. McBaine, speaking for Western Oil and Gas Association, pointed out that 20 of the nation's 29 gas-producing states are deficit-gas areas like California, but that none has sought to control gas prices.

McBaine said that even with an increase of 5.47 cents per M.c.f., which will go into effect January 1, the price paid to southern California producers will be less than the border price of imported gas. The increase is being granted by Pacific Lighting Gas Supply Co., pegging the price of California gas at the border price when figured on a 100% load factor. In reality, it puts field prices slightly under the border price (OJG, Nov. 6, p. 72).

He said there is "no logical reason" why California gas shouldn't demand the same price as out-of-state gas.

The 3-day hearing in Los Angeles last week was the first part of a two-part session. Additional hearings are planned in San Francisco late this week.

How Canada's gas boom is growing

	Production	Sales in Canada	Exports to U. S.	Canadian sales revenue	Export revenue
	(bil. cu. ft.)			($ million)	
1960	520	324	112	194	23
1961 (est.)	650	368	180	225	37
1962 (est.)	950	415	300	260	62
% change 1961 over 1960	25%	14%	61%	16%	61%
% change 1962 over 1961	46%	13%	67%	16%	68%

Source: Canadian Gas Association.

Canadian gas output to soar

NATURAL-GAS production in Canada will soar to another record this year, but the growth recorded in 1961 will be dwarfed next year.

Production in 1961 will total 650 billion cubic feet, according to estimates by the Canadian Gas Association, for a 25% increase. But the biggest gain on record—almost 50%—will boost production next year another 300 billion to a total of 950 billion cubic feet.

A big gain for exports next year will result from completion of the $345-million 36-in. gas line from Alberta to San Francisco, built by Alberta Gas Trunk Line Co., Ltd., Pacific Gas & Electric Co., and others. With this line going into operation, exports next year will be almost three times the 1960 level.

To process natural gas, mainly for export to California, $100 million was invested in new plants last year, CGA reported. The results of this capital expenditure were the following increases in capacity:

Raw-gas capacity from 760 billion to 1,100 billion cubic feet per year.

Residue-gas capacity from 660 billion to 900 billion cubic feet per year.

Natural-gas-liquids capacity from 21 million to 31 million barrels per year.

Sulfur capacity from 0.7 million to 2 million tons per year.

Third-quarter deliveries averaged 25,567 bbl. daily against 24,079 bbl. for the entire 9 months.

The Kirby and Bridger booster stations on the Colorado section of the Platte Pipe Line will be remotely controlled from the Chatham station. A system of remote control, supervision, and telemetering is being installed at the formerly unattended, pressure-controlled stations. The communications circuit will be leased from Mountain States Telephone & Telegraph.

A new propane-storage cavern and truck terminal of Texas Eastern Transmission at Princeton, Ind., will begin operations December 15. The company has Midwest storage capacity of 71,000,000 gal. Under a new tariff arrangement, shippers may withdraw from the terminal on the same day they deliver to the pipeline's point of origin and are no longer required to own or lease storage.

Completion of its 170-mile 8-in. Oklahoma Panhandle line has been announced by Sinclair Pipe Line Co. It runs from Stockholm to Sinclair's main line near Shawnee and has capacity of 17,500 bbl. daily. Construction of the new line and acquisition of the former Wheat Belt line give northwestern Oklahoma and Kansas crude a new outlet to Houston, Chicago, and Wood River refining areas.

A new pipeline will connect Alberta's Twining field with the Britamoil system near Rowley field. The 23-mile 4-in. line is being built by Twining Pipeline, Ltd., subsidiary of Mic Mac Oils, Ltd. Banister Construction is contractor. Initial capacity will be 3,750 bbl. daily. Ultimate capacity is 5,000 bbl. daily.

Two budget-type construction applications have been approved by FPC. El Paso Natural Gas Co. will spend $5,000,000, and Panhandle Eastern Pipe Line Co. will spend $2,500,000. No single project will cost more than $500,000.

FPC has received applications for budget-type construction permits from Tennessee Gas Transmission Co. and Colorado Interstate Gas Co. TGT wants to spend $5,000,000, with no one project to exceed $500,000. Colorado Interstate wants approval for $800,000, with no single job to top $250,000.

Cheaper acetylene keyed to petroleum

Costs of making acetylene can be trimmed dramatically through use of new processes based on petroleum feed stocks, consultant tells AICE meeting.

NEW processes not commercially applied so far may hold the key to materially lower acetylene-manufacturing costs.

Much of the acetylene consumed today is derived from calcium carbide, even though several processes which use petroleum feed stocks have been available. But petroleum-derived "over-the-fence" acetylene is expected to place a much more important part in the consumption picture.

These points were made by Walter Lobo, New York consulting chemical engineer, at the annual meeting of the American Institute of Chemical Engineers in New York last week.

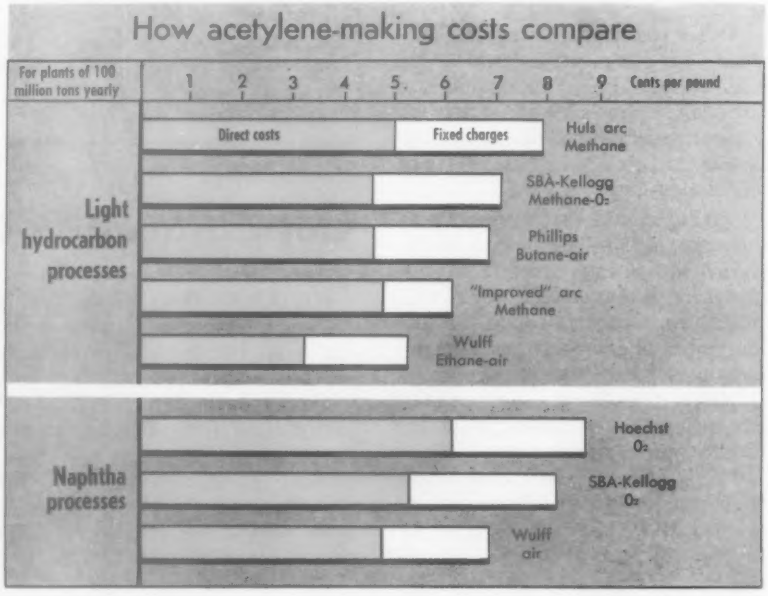
Lobo said acetylene from calcium carbide costs 12-16 cents per pound but existing petrochemical acetylene plants could produce the same material for some 7-8 cents. One process—yet to be tried commercially—could shave this almost 2 cents, he added. Plants involved in these estimates would have capacity of 100 million pounds per year.

From the cost viewpoint, the Wulff direct pyrolysis process looks particularly attractive. Most work carried out in the Los Angeles semi-commercial plant of Wulff Process Co. has been with propane.

When ethane or light naphtha is used as feed stock, the Wulff process takes on an even more favorable position, Lobo said. With ethane valued at 0.7 per pound, acetylene could be produced for 5.26 cents per pound. Use of naphtha—valued at 6 cents per gallon—would increase the cost to 6.84 cents.

Lobo figured the investment for a 100-million-pound plant based on ethane at $11.8 million. For a plant based on light naphtha, the estimate was $13 million.

Selection of a modified electric-arc process by Du Pont for its 50-million - pound Montague, Mich., plant indicated to Lobo that product costs would be lower than in the conventional Huls arc plant. As compared with the 7.95 cents per pound cost of acetylene produced by the latter, he estimated an "improved" arc plant could produce the material for 6.15 cents.



As indicated in the chart, much of the lower cost would stem from lower fixed charges. Investment required for a 100 - million - pound, "improved" plant was estimated at $7.5 million against $17.7 million for a conventional plant of the same size.

Another potential route to cheaper acetylene is the "Tangential Reactor Process" of the Phillips Petroleum Co. Lobo estimated cost would be 6.84 cents per pound when using butane and preheated air, and 6.82 cents when charging propane and oxygen. Investment costs for 100 - million - pound plants were placed at $13.2 million and $11.6 million, respectively.

Cat cracking exploits resid

SUBSTANTIAL increases in gasoline and furnace-oil yields, accompanied by a comparable drop in heavy-fuel-oil output, can be obtained economically by catalytic cracking of reduced crudes.

This conclusion has been reached by a group of M. W. Kellogg Co. engineers after an extensive research program. The economics, they found, depends markedly upon the magnitude of the catalyst-replacement rate, the processing scheme chosen, and the price of heavy fuel oil. Where they are favorable, a good return can be realized from the extra investment required.

A few companies already have taken this route toward disposing of surplus resid. Phillips Petroleum Co. is charging reduced crude to a cat cracker at its Borger, Tex. refinery, for example.

The Kellogg studies, reported last week by K. A. Knaus at the New York meeting of the American Institute of Chemical Engineers, dealt with pilot plant studies. Coauthors of the paper were E. F. Schwarzenbek, P. T. Atteridg, and J. F. McMahon.

A 3-month test program was carried out with an 18°-gravity reduced crude containing 8.3% (wt.) carbon

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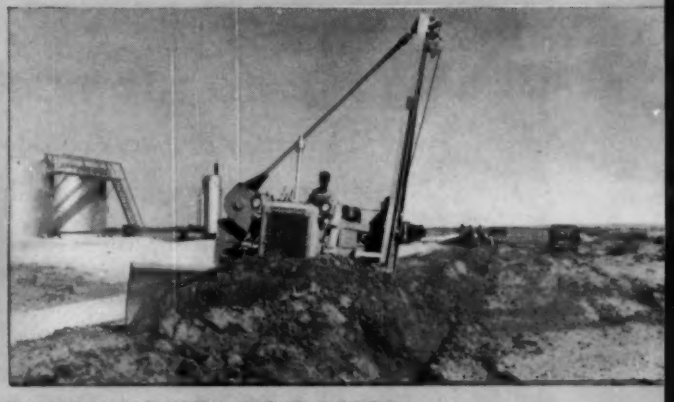

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Owner W. R. Ferguson gave a few details on the variety of jobs they handle with the 561: "Besides the usual assignments of construction and maintenance work, we found the 561 was very efficient taking up old pipe. The 561 can cradle the pipe up out of the ditch and backfill with its dozer as it moves ahead. And since the ditch is filled in, the pipe lays on the surface and doesn't bend.

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CAT PIPELAYERS FOR THE HARD WORK

residue and 113 p.p.m. of nickel, copper, iron, and vanadium. Used synthetic silica-low alumina catalyst was periodically replaced with fresh catalyst, at the rate of 1.0 lb. of catalyst per barrel of feed.

From 14 periods of single-pass operations, data were obtained to determine the effects on product distribution of such variables as temperature, conversion, reactor steam concentration, and catalyst properties. Among the findings:

Increasing the carbon factor increased coke and dry-gas yields, while butane yield was not significantly affected. At constant conversion, the net result was an 8% (vol.) decrease in gasoline yield as the carbon factor rose from 2 to 9.

Gasoline yield at a given carbon factor was strongly influenced by carbon-residue content of the feed, this material appearing entirely as coke on the catalyst.

Quantity of steam fed to the reactor had a marked influence on coke yield.

OUTPUT COMPARISON
(BPSD from distillate-free crude)

	Present refinery	Modified 120,000-bbl.	Difference
Gas (f.o.e.*)	3,420	4,195	+775
Excess C_4's	4,200	5,130	+930
10-lb. R.v.p. gasoline	19,600	22,400	+2,800
Light cycle oil	4,390	11,160	+6,770
Heavy fuel oil	19,710	6,440	—13,270

*Fuel-oil equivalent.

Extending the test data to a hypothetical 120,000-bbl. refinery processing West Texas crude, Knaus showed that reduced crude cat cracking would be quite feasible economically. Without such a unit, over 16% of the crude charge would be marketed as fuel oil (see table).

Charging the 9°-gravity residual fuel to an Orthoflow fluid cat cracker, plus the conversion of a visbreaker furnace to thermal-cracking duty, affected the yield structure as shown in the table.

Although the feed is a vacuum asphalt with 17% carbon residue, nearly 15% gasoline would be produced at 27% (vol.) conversion. Only heavy fuel oil produced under the revised scheme would be the 6,440 bbl. of tar from the thermal cracker.

As to the economics, Knaus said a cash flow of 13% would be realized from a $6.6-million investment, based on heavy fuel oil valued at $2.30 per barrel. Valuing the fuel oil at a price equivalent to natural gas at 20 cents per 1 million B.t.u. ($1.20 per barrel), the cash flow would jump to 46% of the investment.

If the magnitude of the catalyst replacement rate is too low, a high carbon producing factor develops and the product distribution is affected adversely. If too high a replacement rate is practiced, the cost of catalyst becomes excessive.

Drilling rigs to tap nuclear blast cavity

Two rotary rigs working side by side will bore 1,200-ft. holes into super-hot steam pocket created by Project Gnome's underground nuclear explosion.

OILFIELD drilling crews this week were to start boring toward a super-hot cavity in a New Mexico salt deposit where a 5-kiloton nuclear device was exploded.

The Project Gnome shot, scheduled for December 10, is the first U. S. test of nuclear explosives for peaceful purposes. If successful, the results will give the Atomic Energy Commission a better idea of which way to go in planning future tests, such as the proposed nuclear explosion in the Colorado oil-shale deposits.

What Gnome scientists hope to learn in the New Mexico experiment is whether heat from a nuclear explosion can be used to produce steam for running electric-power generators and whether the blast will manufacture radioactive isotopes which can be recovered economically.

Preparation for the New Mexico test began in 1958. AEC contractors dug a shaft 1,200 ft. down into the Salado formation 25 miles southeast of Carlsbad. The bomb detonation chamber was carved at the end of a 1,000-ft. horizontal tunnel connected to the vertical shaft.

Before the explosion two holes were drilled into the detonation chamber and plugged with cement.

If things went as planned, the explosion gouged a 110-ft.-diameter spherical cavity, partly filled with molten salt. The blast's tremendous heat turned 120 tons of water from the salt into steam.

Entry technique. Tapping the cavity is the job of two rigs owned by Moran Bros., Inc., of Wichita Falls, Tex. Moran equipment and men will work under Reynolds Electric & Engineering Co., which handles "hot-hole" entry jobs for AEC.

As soon as possible after the explosion—probably 2 or 3 days—the rigs will move in and start boring out the two plugged holes.

Conventional drilling methods will be used until the bits get close to the explosion area. Then Reynolds will bring in remote-control drilling equipment to penetrate the cavity. Special blowout preventers designed by Shaffer Tool Works will hold in the high-pressure, radioactive steam.

Property protection. Moran doesn't expect to lose any equipment because of radiation. The company's rigs were given a protective coating of special paint. An AEC official says a simple hosing down with water will remove most of the radioactivity.

High temperatures in the cavity likely will do more damage to equipment than radiation, the AEC man said.

AEC assured potash producers and other property owners near the test site that the bomb would cause no damage.

The site is 8 miles from the nearest underground potash mining works, 5.8 miles from a Shell Oil Co. gas well, and 6.5 miles from the El Paso Natural Gas Co. transmission line. Shell temporarily plugged its gas well to guard against possible damage from shock waves.

BP finally notches major Libyan find

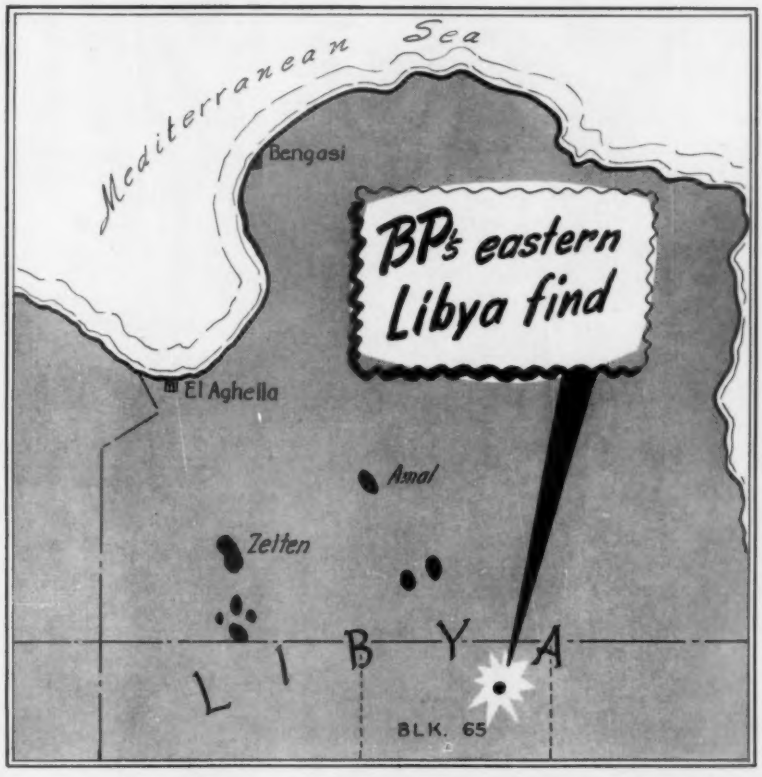
BRITISH Petroleum at long last has a first-class Libyan discovery, a 3,910-bbl.-daily find on a farmout from Nelson Bunker Hunt in eastern Libya.

The find, C1 wildcat on Block 65, flowed 37°-gravity crude from around 8,700 ft. It is about 300 miles due south from the Mediterranean coast and in the northeast portion of the 8,500-sq.-mile concession.

The well is the first producer in Libya's zone EJ and is the country's easternmost oil well.

Hunt won a concession over the uninhabited desert area in mid-1957. BP Exploration bought half interest in the acreage last year and acted as operator. It drilled two dry holes before hitting oil on the third test. A site 2 miles south of the find is being prepared for the first stepout.

A quarter of the vast tract has to be turned back to the government by the end of next year, and the C1 find is almost a sure bet to spur a heavy seismic and drilling program over the entire block in coming months. BP also holds blocks 80 and 81 immediately north and east of the find. Oasis Oil's prolific Block 59 borders the BP-Hunt acreage on the northwestern side.



Until now, BP's only find in 5 years of drilling Libya was a relatively small discovery last year in Northwest Libya on Block 34. It still is drilling in the area.

New Australian discovery flows 250 bbl. daily

UNION Oil has brought in a second discovery in Australia's Great Artesian basin.

The find, 1 Moonie, flowed at the rate of 250 bbl. daily of 48°-gravity crude and an equal amount of water on a drill-stem test between 5,816-5,925 ft. The gas flow was estimated at 400 M.c.f. daily.

The wildcat is 18 miles south of 2 Cabawin, a dry hole, which in turn is 4 miles east of the 60-bbl.-daily 1 Cabawin discovery earlier this year (OGJ, Nov. 6, p. 91).

The new well is the latest indication of oil or gas along an anticlinal trend running northwest to southeast in eastern Queensland.

The Cabawin well lies to the northwest of Moonie, while a 6,000-M.c.f.-daily gas well at Pickanjinnie, near Roma, is about 100 miles northwest of Cabawin.

The type of pay at Moonie was not immediately learned. But the Cabawin find produced from an 8-ft.-net Permian sand. The Pickanjinnie and three other gas wells in the area produce from Triassic. But some geologists speculate that the Pickanjinnie gas may have seeped upward from the Permian, and that Union Oil may have a Permian play in the making to the southeast.

Union Oil's 2 Cabawin was drilled across a fault, and the zone comparable to the 9,928-ft. pay sand in the discovery was found much deeper, with the sands missing.

Union's partners in the program are Kern County Land Co. and Australian Oil & Gas Corp.

Russian exports looming larger

Official figures for 1960 show crude exports to free world jumped 67%—at prices about half those charged the satellites. With further growth this year, total exports to free world now top 500,000 bbl. daily.

MORE THAN 500,000 bbl. daily of Russian oil is now moving into free-world markets.

Official USSR figures show that shipments of crude and products to free-world areas in 1960 totaled 20,406,500 metric tons — about 400,000 bbl. daily—a gain of 42% in one year.

This year, they say, the volume has been further increased by roughly 100,000 bbl. daily of crude oil and products combined.

To move this increasing volume of oil to free-world customers, the Russians cut prices an average of 17.5% on about 220,000 bbl. daily of crude, and to a lesser extent on about 180,000 bbl. daily of products.

The figures give strength to the contention that the Russians are pricing their oil in many cases on political grounds in an effort to upset western markets and to make nations dependent on Black Sea supplies.

This is evident in the wide price spread between oil sold to free world and that sold to communist bloc countries. The average price of crude fob. soviet port or border sold to free-world customers last year was 10.3 rubles per ton, compared with 19.8 rubles per ton to soviet satellites and Red China. This is roughly equivalent to $1.57 per barrel,

In the tables:

All prices are fob. soviet ports or land borders.

The official Russian figures were issued only in rubles and metric tons per year.

Journal conversions are based on $1.11 for the new "heavy" ruble. Crude oil is converted on the basis of 7.3 bbl. per metric ton. Product conversions: gasoline, 8.691 bbl. per ton; kerosine, 7.776; diesel fuel 7.353; and fuel oil, 6.78.

Grand totals in some cases exceed column totals. Small volumes shipped to some small countries were excluded in the country-by-country breakdown.

Crude Oil

	Volume					Value				
	Metric tons (1,000)		Approx. bbl. daily		%	1,000 Rubles		$ per bbl.		%
	1960	1959	1960	1959	change	1960	1959	1960	1959	change
Free World Nations:										
Argentina*		194.5		3,890	−100		1,936		1.51	
Austria	530.7	483.3	10,600	9,670	+9.6	8,954	8,155	2.57	2.56	
Brazil	35.3	59.4	700	1,190	−41.2	401	837	1.73	2.14	−19.1
Cuba	1,648.5		33,000			16,577		1.54		
Egypt	699.9	970.8	14,000	19,420	−27.9	7,498	11,511	1.63	1.80	−9.4
Finland	766.5	899.8	15,300	18,000	−15.0	8,687	10,371	1.72	1.75	−1.7
France	132.3	122.7	2,700	2,450	+10.2	1,401	1,417	1.60	1.76	−9.1
Germany, West	1,240.9	261.4	24,800	5,230	+375.0	11,327	2,910	1.38	1.69	−18.3
Greece	423.7	265.9	8,500	5,320	+59.8	5,400	3,581	1.79	2.05	−12.7
Italy	3,921.0	2,360.3	78,400	47,200	+66.1	36,526	27,194	1.42	1.75	−18.9
Japan	1,183.7	112.3	24,800	2,250	+950.0	10,393	1,239	1.34	1.67	−19.8
Morocco	43.5	64.6	900	1,290	−30.2	524	822	1.83	1.94	−5.7
Uruguay	15.0	325.1	300	6,500	−95.4	209	4,617	2.11	2.16	−2.3
Yugoslavia	351.5	413.4	7,000	8,270	−15.4	5,252	6,407	2.27	2.36	−3.8
Total Free World	**10,992.5**	**6,533.5**	**220,000**	**130,680**	**+68.4**	**113,149**	**80,997**			
Average price to free world						10.3	12.4	1.57	1.88	−17.5
Communist Nations:										
China	567.6	635.9	11,300	12,720	−11.2	10,904	12,365	2.92	2.96	−1.5
Czechoslovakia	2,355.3	1,819.4	47,100	36,390	+29.5	48,634	38,000	3.14	3.17	−1.0
Germany, East	1,780.4	1,582.0	35,600	31,640	+12.5	31,531	28,033	2.69	2.69	
Hungary	1,393.4	1,204.3	27,900	24,090	+15.8	28,016	24,371	3.05	3.07	
Mongolia	25.1	27.2	500	540	−7.4	577	622	3.50	3.50	
Poland	710.6	683.0	14,200	13,660	+4.0	15,317	14,616	3.28	3.25	0.9
Total Communist nations	**6,832.4**	**5,951.8**	**137,000**	**119,040**	**+15.1**	**134,979**	**118,007**			
Average price to Communist nations						19.8	19.8	3.03	3.02	
GRAND TOTAL	**17,824.9**	**12,485.3**	**357,000**	**249,720**	**+43.0**	**248,128**	**199,004**	**2.11**	**2.41**	**−12.4**

*Argentina in 1959 imported about 3,900 bbl. daily.

Gasoline

	Volume					Value				
	Metric tons (1,000)		Approx. bbl. daily		%	1,000 Rubles		$ per bbl.		%
	1960	1959	1960	1959	change	1960	1959	1960	1959	change
Free World Nations:										
Afghanistan	37.9	36.2	900.0	862.0	4.4	1,868	1,917	6.29	6.76	−7.0
Cuba	64.0	.....	1,282.3	.....	....	1,751	.....	4.14	....	....
Egypt	3.2	5.0	76.0	119.1	−36.1	157	196	6.26	5.00	25.2
Finland	33.8	37.5	802.6	892.9	−10.1	960	1,281	3.62	4.36	−17.0
France	76.6	113.5	1,818.9	2,702.5	−32.7	1,896	3,175	3.16	3.57	−11.5
Germany, West	73.5	.....	1,745.3	.....	....	1,230	.....	2.14	....	....
Ghana	.....	0.1	.....	2.4	−100	.....	3	....	3.80	−100
Greece	1.8	5.8	42.7	138.1	−69.1	45	138	3.19	3.04	4.9
Guinea	15.1	0.1	358.6	2.4	(*)	382	3	3.23	3.80	−15.0
Iceland	41.7	42.5	990.2	1,012.0	−2.2	1,214	1,404	3.71	4.22	−12.1
Switzerland	.....	14.3	.....	340.5	−100	.....	351	....	3.13	−100
Syria	0.5	.....	11.9	.....	....	27	.....	6.87	....	....
Uruguay	.....	10.0	.....	238.1	−100	.....	257	....	3.28	−100
Yugoslavia	13.7	12.5	325.3	297.6	9.2	637	632	5.93	6.46	−8.2
Total Free World	**351.8**	**277.5**	**8,353.8**	**6,607.6**	**26.4**	**10,167**	**9,357**	....	....	....
Average price to Free World	.....	.....	.....	.....	....	28.8	33.7	3.68	4.30	−14.2
Communist Nations:										
Bulgaria	291.9	195.4	6,931.5	4,652.7	49.0	9,909	6,844	4.33	4.50	−3.8
China	1,055.2	1,256.0	25,056.8	29,906.0	−16.2	38,535	46,637	4.65	4.74	−1.1
Czechoslovakia	127.4	102.0	3,025.3	2,428.7	24.6	4,204	3,362	4.21	4.21	....
Germany, East	176.6	47.4	4,193.6	1,128.7	271.5	6,451	1,554	4.66	4.19	11.2
Korea, North	119.0	123.9	2,825.8	2,950.2	−4.2	3,703	3,857	3.97	3.98	−0.3
Mongolia	51.0	41.7	1,211.1	992.9	22.0	1,900	1,573	4.75	4.82	−1.5
Poland	589.5	532.1	13,998.3	12,669.8	10.5	19,457	17,419	4.21	4.18	0.7
Vietminh	22.8	28.4	541.4	676.2	−19.9	833	968	4.66	4.35	7.1
Total Communist Nations	**2,433.4**	**2,326.9**	**57,783.8**	**55,405.8**	**4.3**	**84,992**	**82,214**	....	....	....
Average price to Communist nations	.....	.....	.....	.....	....	34.9	35.3	4.46	4.51	−1.1
GRAND TOTAL	**2,818.0**	**2,624.0**	**66,916.2**	**62,013.4**	**7.9**	**96,311**	**92,286**	**4.36**	**4.50**	**−3.1**

*14,840.0.

Kerosine

Free World Nations:										
Afghanistan	2.7	3.6	57	77	−26.0	192	247	10.21	9.75	4.7
Argentina	.....	34.6	.....	737	....	.....	792	....	3.27	....
Cuba	21.9	.....	465	.....	....	516	.....	3.36	....	....
Egypt	238.6	271.3	5,069	5,780	−12.3	5,614	6,620	3.36	3.48	−3.4
Ethiopia	0.1	.....	2	.....	....	3	.....	4.55	....	....
Finland	12.5	21.6	266	460	−42.3	300	565	3.42	3.73	−8.3
Ghana	.....	0.1	.....	2	....	.....	2	....	3.04	....
Greece	0.5	2.2	11	47	−76.6	13	60	3.58	3.88	−7.7
Guinea	5.5	.....	117	.....	....	130	1	3.37	....	....
Japan	.....	1.1	.....	24	....	.....	21	....	2.66	....
Sweden	10.1	11.0	215	234	−8.1	196	245	2.76	3.18	−13.2
Syria	.....	36.5	.....	777	....	.....	974	....	3.81	....
Uruguay	.....	9.3	.....	198	....	.....	192	....	2.95	....
Total Free World	**291.9**	**391.3**	**6,202**	**8,336**	**−25.6**	**6,964**	**9,719**	....	....	....
Average price to Free World	.....	.....	.....	.....	....	23.9	24.8	3.40	3.52	−3.4
Communist Nations:										
Bulgaria	65.1	27.8	1,383	592	133.6	2,007	846	4.40	4.34	1.4
China	386.2	380.1	8,205	8,098	1.3	12,093	11,841	4.47	4.45	0.4
Czechoslovakia	148.4	.....	3,153	.....	....	4,795	.....	4.61	....	....
Germany, East	122.5	.....	2,603	.....	....	3,236	1	3.77	....	....
Korea, North	2.4	10.1	51	215	−76.3	78	323	4.63	4.57	1.3
Mongolia	0.1	0.1	2	2	....	4	6	6.06	9.12	−33.6
Poland	50.0	49.8	1,062	1,061	0.1	1,556	1,479	4.44	4.24	4.7
Vietminh	10.6	21.6	225	460	−51.1	313	649	4.22	4.29	−1.6
Total Communist Nations	**785.3**	**489.5**	**16,684**	**10,428**	**60.0**	**24,082**	**15,145**	....	....	....
Average price to Communist Nations	.....	.....	.....	.....	....	30.7	30.9	4.37	4.42	−1.1
GRAND TOTAL	**1,093.4**	**919.5**	.....	.....	....	**31,366**	**25,626**	....	....	....

Diesel Fuel

	Volume					Value				
	Metric tons (1,000)		Approx. bbl. daily		%	1,000 Rubles		$ per bbl.		%
	1960	1959	1960	1959	change	1960	1959	1960	1959	change
Free World Nations:										
Afghanistan	3.4	4.6	68.3	92.6	−26.3	144	194	6.38	6.36	+0.3
Algeria	41.4	25.6	831.7	515.7	+61.3	825	555	3.00	3.27	−8.3
Argentina	.....	240.9	.....	4,852.9	.....	.....	5,463	.....	3.42	.....
Belgium	34.9	22.3	701.1	449.2	+56.1	648	469	2.80	3.17	−11.7
Brazil	126.1	.....	2,533.3	.....	.....	2,676	.....	3.20	.....	.....
Cuba	31.8	.....	638.8	.....	.....	709	.....	3.36	.....	.....
Denmark	0.9	19.1	18.0	384.7	−95.3	24	456	4.02	3.60	+11.7
Egypt	155.8	167.8	3,130.0	3,380.3	−7.4	3,212	4,077	3.10	3.66	−15.3
Ethiopia	0.1	.....	2.0	.....	.....	7	.....	10.55	.....	.....
Finland	655.3	507.8	13,164.9	10,229.6	+28.7	14,266	12,411	3.28	3.68	−10.9
France	318.6	352.2	6,400.6	7,095.0	−9.8	6,555	8,031	3.10	3.44	−9.9
Germany, West	545.6	614.7	10,961.1	12,383.1	−11.5	9,514	12,856	2.62	3.15	−16.8
Greece	165.9	105.2	3,332.9	2,119.2	+57.3	3,433	2,311	3.12	3.31	−5.7
Guinea	8.0	0.0	160.7	.....	.....	167	1	3.14	3.04	+3.3
Iceland	186.6	188.4	3,748.7	3,795.3	−1.2	3,978	4,669	3.35	3.73	−10.2
Italy	6.0	3.7	120.5	74.5	+61.8	140	88	3.51	3.58	−2.0
Japan	138.1	40.0	2,774.4	805.8	+244.3	2,557	755	2.79	2.84	−1.8
Lebanon	0.9	0.4	18.0	8.0	+125.0	21	11	3.51	4.14	−15.2
Netherlands	37.9	35.4	761.4	713.1	+6.8	722	729	2.87	3.10	−7.4
Norway	32.1	26.2	644.8	527.7	+22.2	655	648	3.07	3.73	−17.7
Portugal	62.7	.....	1,259.6	.....	.....	1,298	.....	3.12	.....	.....
Sweden	417.4	421.8	8,385.5	8,497.1	−1.3	7,940	8,862	2.86	3.17	−9.8
Switzerland	.....	8.8	.....	177.2	.....	.....	167	.....	2.86	.....
Syria	272.3	299.9	5,470.5	6,041.4	−9.5	5,712	6,970	3.16	3.50	−9.7
Tunisia	12.4	4.7	249.1	94.6	+163.3	269	89	3.27	2.85	+14.7
United Kingdom	25.8	2.0	518.3	40.2	.....	528	53	3.08	3.99	−22.8
Uruguay	17.7	48.5	355.5	977.0	−63.6	408	1,091	3.47	3.39	+2.4
Yugoslavia	82.8	2.6	1,663.4	52.3	.....	1,689	68	3.07	3.94	−22.1
Total Free World	**3,380.5**	**3,142.6**	67,914.2	63,307.6	+7.3	**68,097**	**71,024**	**3.03**	**3.41**	−11.1
Average price to Free World nations	.....	.....	.....	.....	.....	20.1	22.6	.....	.....	.....
Communist Nations:										
Albania	.....	2.1	.....	42.3	.....	.....	46	.....	3.30	.....
Bulgaria	305.4	241.3	6,135.4	4,860.9	+26.2	7,691	6,534	3.79	4.08	−7.1
China	708.8	556.6	14,239.7	11,212.7	+27.0	21,557	16,857	4.58	4.57	+0.2
Germany, East	85.7	167.1	1,721.7	3,366.2	−49.0	2,190	4,325	3.12	3.90	−20.0
Korea, North	63.4	77.6	1,273.7	1,563.2	−18.5	2,008	2,372	4.77	4.61	+3.5
Mongolia	44.7	43.5	898.0	876.3	+2.5	1,661	1,641	5.60	5.69	−1.6
Poland	506.9	390.7	10,183.6	7,870.6	+29.4	15,436	11,605	4.59	4.48	+2.5
Vietminh	24.1	20.7	484.1	417.0	+16.1	670	572	4.19	4.16	+0.7
Total Communist Nations	**1,739.0**	**1,499.6**	34,936.5	30,209.4	+15.6	**51,213**	**43,952**	**4.44**	**4.42**	+0.5
Average price to Communist nations	.....	.....	.....	.....	.....	29.3	29.3	.....	.....	.....
GRAND TOTAL	**5,119.5**	**4,642.2**	102,850.7	93,517.1	+10.0	**120,373**	**115,011**	**3.55**	**3.73**	−4.8

against $3.03 per barrel to the Russian sphere.

Transportation costs within Russia in some cases could explain higher prices to satellites. But Black Sea oil going to neighboring free-world and communist countries often sold for a wide differential.

Russian crude went to West Germany for 9.1 rubles per ton, and to East Germany for 17.7 rubles, roughly $1.38 per bbl. against $2.69. Black Sea oil moved to Japan at an average price of 8.8 rubles per ton, and to Red China for 19.2 rubles, about $1.34, as against $2.92.

Russia argues that its statistics do not give a true picture because the USSR, in turn, pays more for imports from its satellites. But while the Russians made substantial price cuts on crude and products sold to free world markets last year, the prices charged communist bloc neighbors remained almost level. Unless Russia paid more for its imports from these countries its own figures show it gave preferential treatment to non-communist countries.

Cuba, by admission of Premier Castro, is now in the communist camp. But Russia in one respect last year treated the island as a non-communist country. After the nationalization of the private refining and marketing business in Cuba at mid-year, Russia started supplying oil at prices in line with those of free-world countries.

Aside from Cuba, the biggest impact of Russian oil last year was made in Italy, West Germany, and Japan. All three countries are in a position to sell steel pipe and other equipment in short supply in Russia which will enable the soviet industry to progress that much faster. Italy is now the largest importer of Russian oil in the world, communist or non-communist.

Outside of Cuba, Latin America was one market where Russian gains were slowed last year. Argentina's growing crude production enabled it to end soviet imports entirely.

Fuel Oil

	Volume					Value				
	Metric tons (1,000)		Approx. bbl. daily		%	1,000 Rubles		$ per bbl.		%
	1960	1959	1960	1959	change	1960	1959	1960	1959	change
Free World Nations:										
Afghanistan	0.3	.....	5.6	.....	.....	22	.....	11.90	.....	.....
Algeria	20.1	.....	372.4	.....	.....	190	.....	1.54	.....	.....
Argentina	.....	9.4	.....	174.6	−100	.....	95	.....	1.65	.....
Belgium	168.2	171.9	3,115.9	3,193.0	−2.4	1,471	1,619	1.43	1.54	−7.1
Cuba	388.9	.....	7,204.4	.....	.....	3,404	.....	1.43	.....	.....
Denmark	151.7	76.9	2,810.2	1,428.4	+96.7	1,528	736	1.65	1.57	+5.1
Egypt	237.1	487.4	4,392.3	9,053.5	−51.5	2,197	4,757	1.52	1.60	−5.0
Ethiopia	0.3	.....	5.6	.....	.....	5	.....	2.71	.....	.....
Finland	653.0	381.4	12,096.8	7,084.5	+70.8	7,310	4,537	1.83	1.95	−6.2
France	257.7	219.2	4,773.9	4,071.6	+17.2	3,082	2,799	1.96	2.09	−6.2
Germany, West	140.1	167.4	2,595.4	3,109.5	−16.5	1,299	1,891	1.52	1.85	−17.8
Greece	355.2	44.9	6,580.1	834.0	+789.0	3,200	484	1.47	1.76	−16.5
Iceland	110.9	134.5	2,054.4	2,498.3	−17.8	1,490	1,800	2.20	2.19	+0.5
Italy	774.0	670.4	14,338.4	12,452.7	+15.1	7,164	6,382	1.51	1.56	−3.2
Japan	81.8	1.7	1,515.3	31.6	.....	662	16	1.33	1.24	+7.3
Lebanon	85.4	65.6	1,582.0	1,218.5	+29.8	665	613	1.27	1.53	−17.0
Netherlands	1.8	12.1	33.3	224.8	−85.2	25	147	2.27	1.99	+14.1
Norway	216.4	236.6	4,008.8	4,394.8	−8.8	2,110	2,396	1.59	1.66	−4.2
Sweden	1,537.8	1,017.9	28,487.7	18,907.5	+50.7	13,688	9,126	1.46	1.47	−0.7
Switzerland	28.5	16.3	528.0	302.8	+74.4	206	162	1.18	1.63	−27.6
Syria	.....	112.0	.....	2,080.4	−100	.....	1,113	.....	1.63	.....
Tunisia	.....	9.0	.....	167.2	−100	.....	99	.....	1.80	.....
Turkey	6.6	0.7	122.3	13.0	+840.8	90	12	2.23	2.81	−20.6
United Kingdom	177.2	58.6	3,282.6	1,088.5	+201.6	1,686	654	1.56	1.83	−14.8
Uruguay	38.7	107.8	716.9	2,002.4	−64.2	337	1,058	1.42	1.61	−11.8
Yugoslavia	8.1	9.7	150.1	180.2	−16.7	114	145	2.30	2.45	−6.1
Total Free World	**5,439.8**	**4,011.4**	**100,772.4**	**74,511.8**	**+35.2**	**51,945**	**40,641**	.....	.....	.....
Average price to Free World nations	.....	.....	.....	.....	.....	9.6	10.1	1.56	1.66	−6.0
Communist Nations:										
Bulgaria	116.6	57.8	2,160.0	1,073.6	+101.2	1,227	583	1.72	1.65	+4.2
Hungary	48.8	54.5	904.0	1,012.3	−10.7	852	951	2.86	2.86	.....
Korea, North	2.4	7.1	44.5	131.9	−66.3	57	178	3.88	4.10	−5.4
Poland	166.8	108.7	3,090.0	2,019.1	+53.1	2,743	1,671	2.68	2.52	+9.4
Total Communist Nations	**334.6**	**228.1**	**6,198.5**	**4,236.9**	**+46.3**	**4,879**	**3,383**	.....	.....	.....
Average price to Communist nations	.....	.....	.....	.....	.....	14.6	14.8	2.38	2.43	−2.1
GRAND TOTAL	**5,774.4**	**4,239.5**	**106,970.9**	**78,748.7**	**+35.8**	.....	.....	.....	.....	.....

Uruguay and Brazil, which have encountered domestic criticism for doing business with communists, have reduced Black Sea imports.

Russia also exported about 266,000 bbl. daily of crude and products in 1960 to its satellites and Red China, countries where markets for Russian oil are growing at a slower rate than in the free world. Over-all exports to both free-world and Red bloc nations totalled about 666,000 bbl. daily, up 30% over 1959.

Russian imports declined slightly to 4.4 million tons last year, or about 88,000 bbl. daily. About 20,000 bbl. daily was accounted for by 20,000 bbl. daily of crude from Austria. Most of the balance was made up of product imports from Romania, including about 20,000 bbl. daily of gasoline.

Independents to explore Togo

ANOTHER combine of independents has plunged into the burgeoning African oil play.

A newly formed company, Togo-American Oil Co., Inc., Dallas, has negotiated a concession covering the Republic of Togo.

Frank K. Fisk, Dallas, company president, says the firm plans to invest at least $5,000,000 exploring its new holdings. A geophysical crew is to go to work on the concession in January and put down the first well, probably in the vicinity of Anechoon, later in the year.

Fisk said exploration will be confined to a 1,200,000-acre area in the Niger River basin along the coast. Roughly a fourth of this area lies off the coast of the republic.

Togo has no oil production now. But possible oil-bearing sediments range down to about 12,000 ft., Fisk says. The concession gives the company both exploration and exploitation rights for a period of 3 years, with an option to renew for another 3 years.

Terms initially would give the Togo Government one-eighth of the value of any oil produced, with a 50-50 profit split to take effect at an unspecified later date.

Togo-American also gets the right to build a refinery in the country. Current oil demand there is placed at roughly 1,000 bbl. a day.

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PROBLEM IN OIL | To bring order to a disorderly transition

An important phase of action in the Organization of Petroleum Exporting Countries deals with the methods to be devised for allocating production among member countries. At the Third Arab Petroleum Congress in Alexandria, some recommendations on this matter were voiced by Alirio A. Parra, chief of the Division of Petrolum Economics, Venezuelan Ministry of Mines and Hydrocarbons. A condensation of his paper, presented here, gives some insight into the thoughts of the Venezuelan Ministry, which are important because of that nation's prominent position as a world exporter of petroleum. A Venezuelan is slated to head the influential Enforcement Department of OPEC, which will be charged with carrying out decisions of member countries.

IT IS recognized that consuming countries wish to insure steady supplies of oil at fair prices for their future energy needs. At the same time oil companies hope for a rate of return which is not below that obtainable from other industries or investment opportunities.

Supplies of oil are sufficient to meet present-day needs but at present-day prices may not be sufficient to maintain the capacity essential for future needs.

The problem as such is to bring order to a disorderly transition in oil. It seems clear that the only organization capable of coordinating some action is the OPEC with the backing of its member countries.

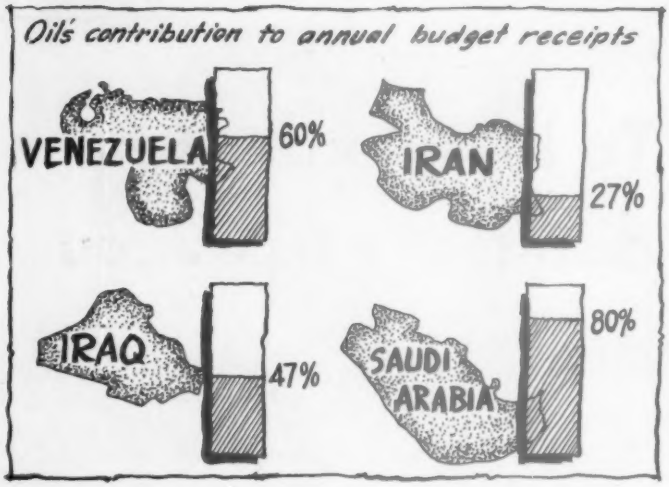
There is a close relationship in underdeveloped countries between exports of petroleum and refined products, GNP, availability of foreign exchange funds, and the capacity to import. The formation of capital and economic development in general are in turn related to the capacity to import capital goods.

Price stability of petroleum is one of the essential conditions for planning economic growth.

Stability and oil prices. The problem of price instability is really twofold. One is concerned with the downward drift in primary product prices; and the other is that of adjusting to sharp fluctuations in prices. The pricing problem in petroleum is more closely related to the first but the second is present.

In petroleum and many other primary commodities, changes in supply conditions tend to be reflected in more than proportional changes in price. The demand for petroleum is considered to be generally inelastic; that is, in the short run at least it is unresponsive to changes in price, so that a slowing of demand or increased availability of supply can have potentially explosive repercussions pricewise.

The Venezuelan system is based on the premise that there should be one world market price for oil and not a series of different prices for different destinations.



Budgets of developing nations are extremely vulnerable to fluctuations in petroleum prices. An increase in volume accompanied by a decrease in price adversely affects treasury receipts from oil.

The growth in demand for petroleum reflects world industrial expansion and rising living standards. Some recent measures have had the effect of depressing this rate of growth. For example, the mandatory oil-imports program in the U. S. has placed a limit on the size of the U. S. market for foreign crude. Tariffs and other internal restrictive measures taken by the several European nations have served to further weaken crude and product prices and in some cases to restrain consumption of heavy products.

The tax increases in the consuming countries are often reflected in lower prices at the source of supply.

On the supply side, there are several factors which have tended to increase production or the capacity to produce. However, excess capacity in itself is not the cause of price weakness and such overcapacity has existed for many years.

Many new firms have recently found oil in different parts of the world. The newcomers, mainly medium and smaller-sized firms with little experience in world markets, want to produce so as to realize a return on their investment.

Although the newcomers represent only a small percentage of current output, they have stimulated production which cannot be easily absorbed in new markets, and this has resulted in competition for the outlets of rival producers or of the already established marketers.

Fiscal income and oil. A close relationship exists between total fiscal receipts and revenues from the oil industry. These in turn are largely dependent upon the volume and prices of petroleum exports. The budgets of the developing countries are extremely vulnerable to fluctuations in petroleum price. An increase in volume accompanied by a decrease in price affects adversely treasury receipts from oil. Based on actual production, it is estimated that the fiscal income foregone by the Middle East and Venezuela amounted to $123 million and $82 million, respectively, in 1959 and to $190 million and $102 million, respectively, in 1960.

In Venezuela, income from oil accounts for over 60% of budget receipts. There exists a similar dependence in some Middle East countries; for example, oil contributes 27% to the budget of Iran, 47% of Iraq's total income, and in Saudi Arabia the contribution is over 80%.

Historically, world crude postings or, in the absence of these, effective sales price, have been closely linked to U. S. price and in particular to the price of Texas crude oils. However, over the last few years this link has gradually weakened so that the U. S. no longer exercises the same dominant influence over world price movements, especially with reference to Eastern Hemisphere oil.

What is the solution? Here are three different approaches to the problem of stabilization of prices. One we call the Coordinating Commission method. It presupposes a high level of authority over company marketing practices and a reasonable though not rigid restraint on the part of member governments. The commission can also serve as an instrument for applying other methods.

The second method is called the Reference Formula method, whereby prices are tied to an agreed-upon reference point and move periodically as freight rates are calculated. It is the only method which actually sets a price level.

The third is the Proration method, by which supply is controlled at the source. A variety of factors is used to establish a fair distribution of production allowables.

Each method involves different degrees of governmental control. They can either be used individually or in a combination of two or three. One method may be better for the short as opposed to the long run, or may be considered more practical than a more theoretically perfect method.

Coordinating Commission Method

The Venezuelan Coordinating Commission for the Conservation and Commerce of Hydrocarbons was founded on April 9, 1959, 5 days after the second 1959 reduction in prices. In creating the commission, an organization capable of studying, recommending, and of coordinating them with conservation policy, a num-

ber of considerations were taken into account. They include the fact that Venezuela is the principal oil exporting country, and that on some occasions its economy has been impaired by unwarranted changes in the price structure.

The need of measures for the conservation of oil and gas, an irreplaceable natural wealth, is recognized in order to obtain a reasonable stability of prices. Furthermore, the stability of prices and markets is indispensable for the maintenance of an economically healthy industry, capable of satisfying the ever-growing energy needs of the world economy.

It can be said the Coordinating Commission approach is basically concerned with the economic aspects of conservation—that is, the avoidance of waste aboveground. In the case of Venezuela this must be firmly related to a normal rate of production and to the defense of fair prices.

In practice, it has been found that excess producing capacity or substantial proved reserves do not in themselves weaken the price structure. It is the knowledge that this capacity may be put on the market that has had adverse effects on the normal development of prices and markets. A situation of confusion approaches as newcomers place additional supplies on the market in excess of normal demand. Several independent commentators have observed that prices would be far different today were it not for the stabilizing effects of the commission.

Functions and activity. How does a Coordinating Commission function and from where does it derive its authority? This is best illustrated by the concrete example of the Venezuelan commission.

First, in Venezuela it derives its authority from the National constitution, from the original decree creating it, and from Resolution 994 which prohibits the sale of hydrocarbons with abnormal discounts that are contrary to the national interest.

Apart from the legal framework, the commission works with the minimum of ground rules and with a great deal of feel for the market place.

The outstanding activity of the commission is the twice-yearly survey of prices and discounts. Questionnaires are sent to the 50 companies or so which produce or sell Venezuelan crudes, requesting detailed information on the sales programs for the following 6-month period and on actual export sales realized during the preceding period.

The commission studies with particular care the details of prospective sales in order to prevent abnormal discounts. It has always been easier to prevent than to modify a situation which has already developed. In Circular Letter No. 3287-H, the commission requested that the companies submit any new contract which purports to affect sales below posted prices. The commission has prohibited outright many new marginal sales with abnormal discounts, thus taking off the market that oil which is precisely most harmful to the price structure.

The Coordinating Commission does not by any means limit its activity to preventing the execution of contracts that have not entered into force. Decree 994, published in August 1960, concerning abnormal discounts has given its greater authority. The decree states that . . . "This Ministry will order the suspension of production which in the judgment of the Coordinating Commission is destined for sale at abnormal discounts."

The commission has always preferred to make suggestions and to employ persuasive techniques as a means of implementing its decisions. However, in a few cases Decree 994 has been invoked. Last year, the commission succeeded in having the companies renegotiate 36 sales contracts to eliminate discounts considered to be abnormal.

These activities are correlated with monthly production estimates and with permanent market surveys to evaluate the position of Venezuelan crudes. The companies have also been asked to notify the Ministry of any loss of markets as a result of penetration by cheaper crudes. This information has been particularly useful in evaluating the situation.

Improvement of prices. The policy of price stabilization has had good results in the face of strong pressures for lower prices. During the period January-June 1961, as compared with the same period of 1960, the commission managed to reduce discounts appreciably. Discounts offered by the concession holders on crude-oil sales were reduced by 4 U. S. cents per barrel. The participants—those having financial interests in concessions operated by other companies—were also obliged to reduce their level of discounts. Most production is sold with less than 5% off the posted price.

Reference Formulas

In the Caribbean, a uniform f.o.b. system had become established a few years before prices were publicly posted in 1952. This single f.o.b. price was closely related. until very recently, to the actual netback on shipments to the U. S. East Coast. The two basic factors accounting for this are the proximity of Venezuela to the United States market and the fact that over 40% of Venezuelan exports go to the U. S. East Coast.

Venezuelan crude prices consistently followed U. S. price changes and it is logical to relate this to the proximity of the market and to its importance in the pattern of distribution. However, the April 1959 price cut was a break with the system and produced a price which was below the maximum for Venezuelan crudes which is determined by the netback from the U. S. East Coast.

In the Middle East when World War II ended, a separate base point had been set up. Between 1954 and 1949, crude-oil prices in the Persian Gulf moved through a range from a high set at the same level as the U. S. Gulf base price to a low that corresponded approximately to the netback on shipments to the U. S. East Coast. This range roughly followed the rapid growth of Middle East crude-oil production and successively used the Naples, London, and New York equalization points. It was very roughly though not uniformly valid until the 1957 price adjustments. The 1957 increase and the 1959-1960 cuts served to lower the price of oil in a market in which it was already fully competitive and therefore these changes find no economic justification.

New reference systems. The Ministry of Mines has

" . . . evaluation of crudes by intensive refining methods should be avoided . . ."

developed a number of reference formulas using different crudes, a variety of equilibrium points, and a number of freight rates. These formulas are based on Venezuelan posted prices which in turn are related, though not quite as closely as before, to East and West Texas prices. A different set of formulas using U. S. poster prices could be drawn up if needed.

The system is based on the premise that there should be one world market price for crude and not a series of different prices for different destinations. It should be mentioned here that although none of the formulas developed seem to be completely satisfactory, they do form the starting point for further studies.

Objectives and conditions. The basic objective is to set a world price for crude which will be generally satisfactory to all net exporters but which at the same time will not meet the outstanding opposition of consumers or of the operating companies.

Any formula which pretends to be successful must be readily understood and easy to administer with a minimum of cost and specially trained personnel. Differentials for minor quality differences must be avoided whenever possible. Posting should be by reference to certain established and well-acceptable crudes. The evaluation of crudes by intensive refining methods should be avoided as this would only lead to different prices according to the needs of each refiner.

The crude oils compared in this paper for purposes of arriving at a reference formula are Arabian and Oficina, both adjusted to the same gravity, and Kuwait and Tia Juana medium also adjusted. These crudes were chosen upon the advice of the refinery engineers of the Ministry of Mines and Hydrocarbons. However, it should be pointed out that any of a number of other crudes could have been compared.

For more practical purposes the method for comparing these crudes would have to be agreed upon. Perhaps the method used in Venezuela for matching crude oils for royalty purpose could be extended or modified to make it universally acceptable. Gravity is the major criterion because it indicates the approximate proportions of low and high boiling-point components. However, it is by no means the only one.

Among the other factors to be taken into consideration are the characterization factor, sulfur content, product yield, and the general quality of the products measured by methods such as diesel index of distillate fuels, smoke point of kerosine, and octane numbers of straightrun gasolines.

Freight rates. A word on freight rates is appropriate at this stage. The c.i.f. value of given crudes depends very much on the level of the tanker market and on which particular freight rate has been used. In general, if crudes from different sources are to be equally attractive in a given market, the f.o.b. price must be adjusted to compensate for difference and fluctuations in freight rates.

The world tanker market, excluding the U. S. flag ships, is virtually a single highly competitive market. In other words, the charter rates for all major routes tend to rise and fall together. This occurs because the ships in the fleet can seek employment in the most profitable trade. There is thus theoretical justification for employing identical rates for the routes we have chosen.

The problem which faces us here is that of devising a relatively simple method of averaging out freight rates which can be considered truly representative of all freight rates during the period under question.

Freight rates are generally expressed in terms of a percentage variation of a nominal reference freight schedule. Those schedules in use today include USMC (United States Maritime Commission), ATRS (American Tankers Rate Schedule), and London Scale No. 3. However, none of these schedules is at all representative of the real level of rates. Since 1954, an average rate has been arrived at by a method known as the Average Freight Rate Assessment (AFRA) which is calculated on the weighted average of rates under which all tankers in the world service are trading. AFRA rates were first established by Shell Oil Co. in collaboration with the London Tankers Brokers as a basis on which it and other oil companies could calculate transport charges when shipments are made in company tankers or "mixed" fleets. This average assessment is not considered satisfactory by all charterers.

Mechanics of the formula. In more detail, the basic price formula used is the following:

Actual f.o.b. price Venezuelan port + freight rate = c.i.f. price point of equilibrium − freight rate = calculated f.o.b. price Persian Gulf.

The formula gives a different equalization price at each equilibrium point for both Venezuelan and Middle East crudes The equilibrium points selected for purposes of analysis are Naples, London, Rio, and New York. For each equilibrium point the f.o.b. price in the Persian Gulf has been calculated.

Let us take an example. If London is selected as the point of equilibrium then the calculated f.o.b. Persian Gulf price for 35° API Arabian crude is explained as follows:

$2.80 f.o.b. price Oficina, Puerto La Cruz = $0.43 freight rate Puerto La Cruz to London (ATRS-50) = $3.23.

C.i.f. price London − $0.78 freight rate London to Persian Gulf (ATRS-50) = $2.45 calculated f.o.b. price Ras Tanura.

This calculated f.o.b. price represents the net realized price on shipments to London at which point the laid-down costs are such that Oficina and Arabian crudes are competitive.

The calculated f.o.b. price Ras Tanura serves as the uniform price to all purchasers. Prices at points, other than London, are given by the $2.45 price plus freight rate to the given port of destination:

	Oficina Posted price	Ras Tanura Posted price	Calculated price (Equilibrium point London)
F.o.b.	2.80	1.82	2.45
Freight rates (ATRS-50) c.i.f.			
Naples	3.26	2.40	3.03
Rotterdam	3.23	2.60	3.23
London	3.23	2.60	3.23
Stockholm	3.31	2.68	3.31
New York	3.00	2.73	3.36
Rio	3.14	2.68	3.31
Montevideo	3.23	2.65	3.28

Proration Method

If an international proration plan is to be considered, then a wide variety of factors should be analyzed so as to allow for an equitable distribution of future increases in world demand. The suggestions here made are concerned with arriving at a fair distribution of allowed production among the net exporters. The allowable assigned to each country could be distributed internally in a manner best suited to the legal structure of that country and compatible with local industry practice.

General considerations. Different approaches have been examined in connection with the possibility of prorating the output of the net exporting countries. The concept of proration here is directed toward the avoidance of waste aboveground. It is both an economic and technical concept.

The idea of a formal proration plan is to maintain as nearly as possible present-day production rates and marketing arrangements but would allow for orderly growth with maximum benefits for each country. Volumewise, very little if any oil would be taken off the market. However, the pressures and the fears of surplus oil would be removed permanently.

The aim of an international proration plan should be the equitable distribution of the estimated increased production among the member countries, thus avoiding the competitive pressures to lower the price level. The object is not to set prices at any given level but to avoid undue fluctuations in the price structure by the elimination of waste above ground.

Factors for analysis. The Venezuelan Ministry of Mines has analyzed several factors which could contribute to the equitable distribution of the expected increase in demand. These include factors directly dependent on oil-industry activity and those which are related but not directly dependent. These factors are described below:

Directly dependent variables:

1. Production growth rate: If the growth of the economy of each country is to be maintained, previous average production increase should be taken into consideration. In this case, countries with a high share of the expected increase in production in order that the pace of their economic growth may not be checked.

2. Production potential: The ratio of annual production to proven reserve may be used as a criterion for production potential. A country using a relatively high percentage of its oil reserve will be checked by this factor. It also serves the purpose of conservation.

3. Capital invested: A country with a great deal of capital invested in the oil industry should be assigned a higher share of expected production increase than a country with a lower level of capital investment in oil.

Indirectly dependent variables:

4. National income: The percentage contribution of the oil industry to the national income shows the relative importance of each industry to the economy. Although diversification of production is desirable, any given program should not change drastically the relative importance of the oil industry in each country.

5. Government revenues from oil: A formula should maintain the relative position of each country as far as government revenues from oil is concerned.

6. Oil exports: Because oil exports provide the foreign exchange needed for the economic development of the oil-producing countries, the percentage of oil exports to the country's total exports should be included in considering measures to distribute supplies.

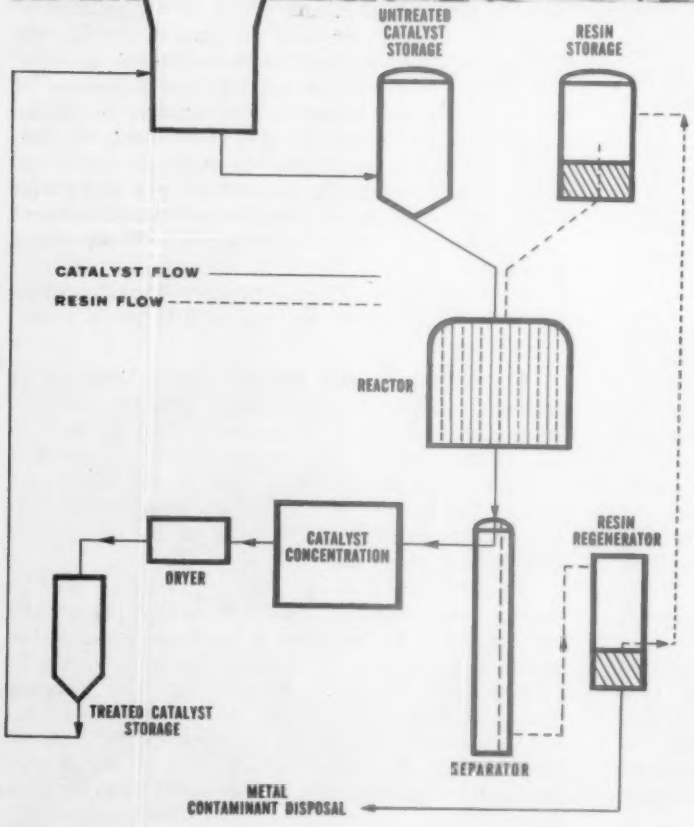
7. Per capita oil income: Previous per capita income from oil should be maintained. A country with a high rate of population growth would need to expand its oil industry to meet the demand of such population increase.

8. Employment: The percentage of the oil workers in the labor force may be used as a factor in a proration plan.

Forecasts of market demand. Before increases in production can be allocated among member countries, the market demand for oil needed to meet the demand for refined products. The bureau gathers a great deal of information which throws light on the amount of oil that will be needed the following month from current production, and on the basis of this information prepares a monthly forecast.

In the case of an international proration plan, a coordinating committee would have to meet periodically and undertake forecasts of market demand in the principal markets for oil. Perhaps the market could be broken down by zones or countries. The forecasts should be made on a quarterly basis, with estimates for the following 12 months by quarters. On the basis of this forecast, an estimate of the size of the market for the oil of participating nations could be made after taking into account normal supplies from nonmembers.

Technology

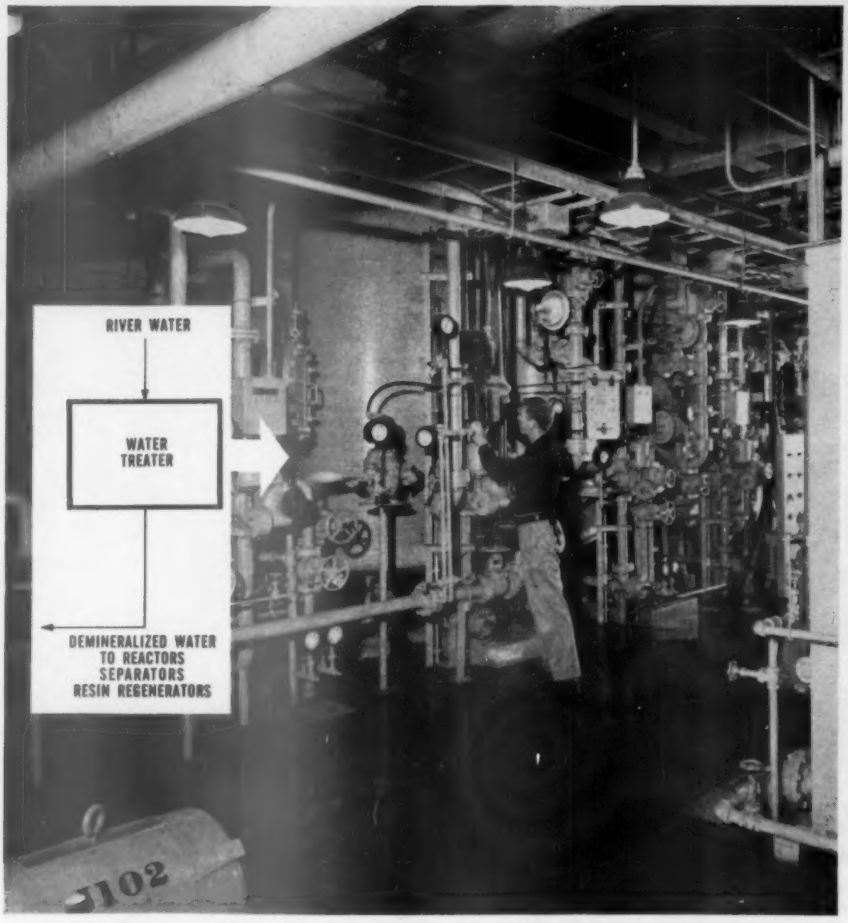


CONTAMINATED CATALYST from two cat crackers at left and center is restored to original activity in plant at right. Simplified flow sheet shows purification steps.

First Met-X now in

Atlantic's new process for removing active metal contaminants from catalyst ranks as major advance in catalytic cracking

BY D. H. STORMONT
Refining Editor



WATER-TREATING SECTION produces highly purified water for use in the process. River water is charged to the treater and completely demineralized by coagulation, filtration, and ion exchange.

plant is operation

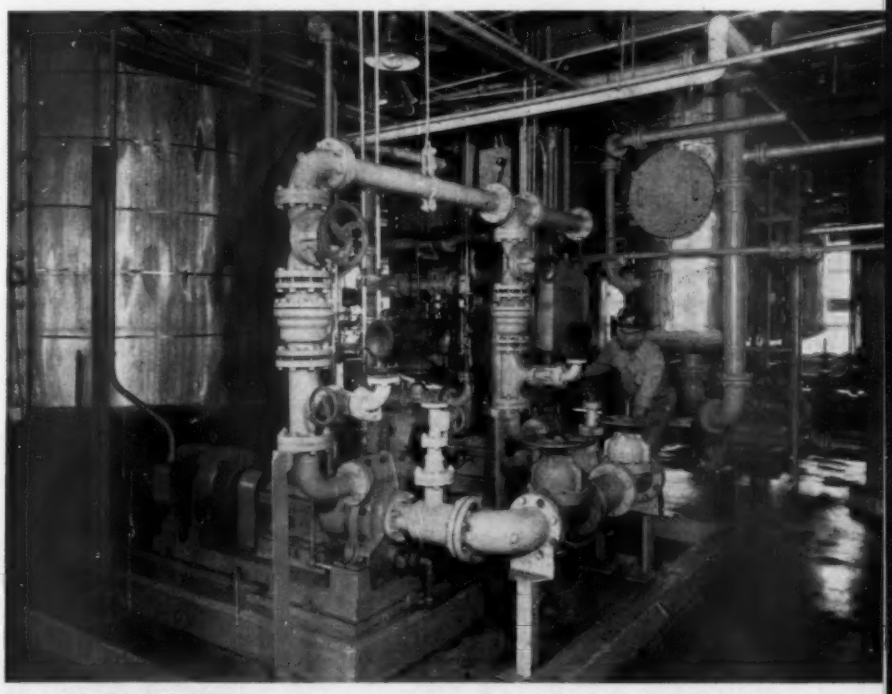
FIRST COMMERCIAL application of a process for removing metal contaminants from cracking catalyst is undergoing its shakedown run at the Philadelphia refinery of Atlantic Refining Co. The Atlantic-developed process continuously recieves a slipstream of contaminated catalyst from two fluid cat crackers with combined capacity of 48,000 bbl. per day. After passing through the plant, catalyst is returned with its original activity restored. Capacity of the unique plant is 40 tons of catalyst daily.

An Atlantic official has stated the installation will result in an annual saving of at least $1,000,000. This will accrue both from lower catalyst consumption and higher yields of high-purity products.

In addition to lowering the costs of catalytic cracking such stocks as heavy gas oils, Met-X may prove a very useful tool for cat cracking reduced crudes. Extension of the process to the extremely high metal-contaminant loads involved in such feed stocks has been successfully demonstrated in pilot-plant operations.

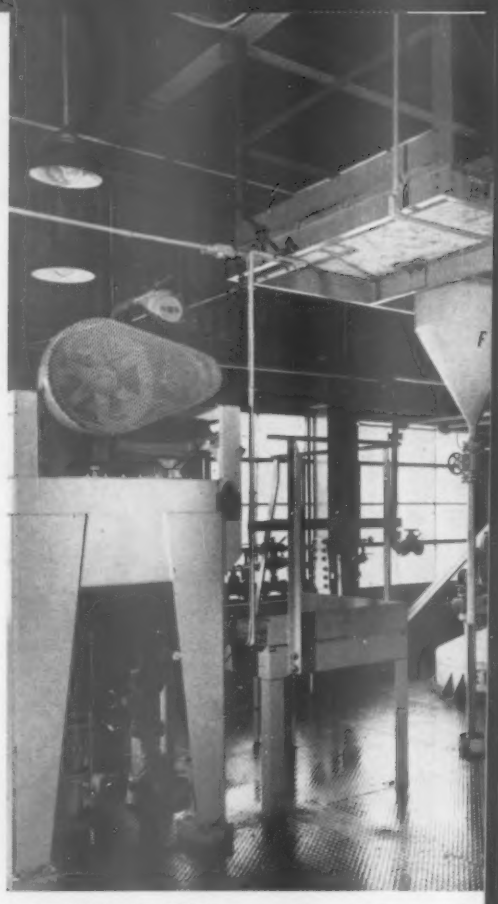
The metals problem. Metal contaminants, such as iron, nickel, sodium, and vanadium, are one of the major deterrents in optimizing cat cracking operations. Deposition of these materials on the catalyst results in increased coke production, and greater yields of hydrogen and light hydrocarbons at the expense of more valuable products.

Some coke laydown is inherent to the cracking operation. Major sources are that formed when a hydrocarbon is cracked over an acidic catalyst, and that entrapped in the pores of the catalyst during regeneration. Studies made by Atlantic engineers, however, show that 30% of the total coke yield in its fluid



RESIN REGENERATION SECTION receives the resin slurry from the separation section. Metals extracted from the catalyst are displaced from the resin by acid wash. A water rinse completes the treatment.

REACTION SECTION consists of four jacketed, mechanically agitated kettles. In these kettles the contaminated catalyst and resin are mixed on a fully automatic cycle. It is here that the metal contaminants are transferred from the catalyst to the resin.



SEPARATION SECTION is an elongated vertical column (shown at right) in which the finely powdered catalyst and the resin particles, coming from the reaction section in the form of a water

cat crackers results from metals poisoning.[1]

The extremely low concentrations of the metals, and the fact they exist in organic forms, make their removal very difficult. Acid treatment has been found to be successful but results in adverse effects on other desirable catalyst properties.

Studies of the Atlantic researchers have shown it is not necessary to remove all of the accumulated metal poisons, however. As reported by Crane, Conner, and Masologites, the metals lose a substantial part of their effectiveness as the catalysts containing them are exposed to the alternating oxidizing and reducing atmospheres present in the regenerator and reactor. Consequently, only a small part of the metals on the catalyst is present in the active form.

The Met-X process selectively removes these active metal contaminants, Atlantic claims. In so improving the catalyst's selectivity, its stability and other desirable characteristics are not altered. Also the metals remaining are not reactivated when the catalyst is returned to the cat cracker.

How it's done. How decontamination is carried out is schematically shown in an accompanying flowsheet. Atlantic is keeping details under wraps but process highlights are as follow:

On a continuous batch basis, untreated catalyst gravities from storage to one of four reactors. Their operation is regulated so that while one is being charged, two are in the reaction stage and one is being discharged. Each of the 4,000-gal. jacketed kettles is mechanically agitated.

Also charged into the reactor is the proper quantity of ion exchange resin, a solid acidic material with which metal ions on the catalyst will react immediately and cause them to flow from the catalyst to the resin. The resin is introduced as a slurry, using very high-purity, demineralized water.

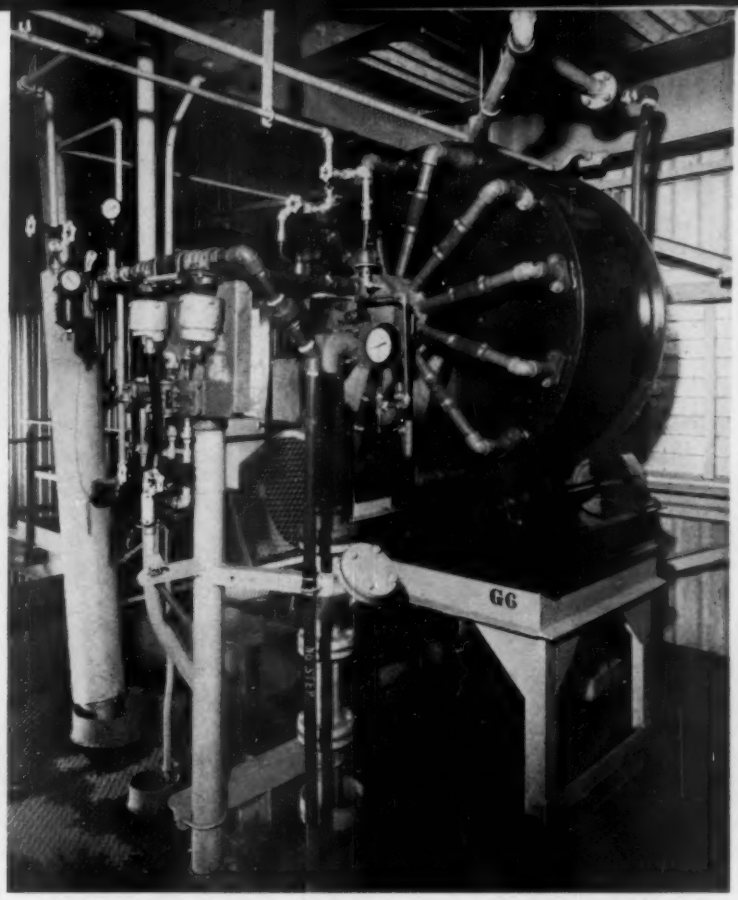
After a reactor is charged, the catalyst and resin are thoroughly mixed under closely controlled conditions. The operation is automatically time-cycle controlled to assure that all metal contaminants are transferred from the catalyst to the resin. Time period required for this transfer, as well as temperatures and pressures involved, have not been disclosed.

When the reaction is complete, the reactor load is dumped into two separators. In these elongated, vertical columns the finely divided catalyst and resin particles are separated, the former going to a recovery section and the resin to a regeneration section.

In the treated-catalyst-recovery section, water is removed from the catalyst by means of a vacuum filter and the catalyst then further dried. Restored to a good-as-new condition, the catalyst is run to storage from where it is withdrawn to the cat cracker.

The resin slurry from the separation section is restored to its original condition by means of two acid washes, followed by a water rinse. Metals extracted from the catalyst are displaced from the resin by the

slurry, are separated. Resin particles go to regeneration section, while catalyst goes to recovery section.



TREATED-CATALYST RECOVERY SECTION contains the equipment which finally prepares the catalyst for reuse. The catalyst slurry from the separation unit is concentrated, dried in this vacuum filter, and returned to the catalytic cracking units.

acid, and are disposed of in a waste-water-treating system separate from other plant wastes.

An important phase of the reaction system is the Permutit water-treating plant, since any contaminants in the water would be transferred to the catalyst. Through use of coagulation, filtration, and ion exchange, completely demineralized (less than 1 p.p.m.) water is produced from river water.

Since the plant is the first of this type ever built, and construction was started before final phases of research and development were completed, several complex engineering problems were presented. Most of these were associated with the metering, transport, and separation of finely divided solids in suspension. Pfaudler Co. assisted in solving some of these, and was a major equipment supplier.

Among the unique control devices used is a gamma-ray radiation detector which records the movement of resin in the system. An echo meter, the first of its kind in the petroleum industry, uses ultrasonic pulses to measure the efficiency with which the catalyst and resin particles are being separated.

Results of treatment. Based on first-month operations, the unit has demonstrated the ability to duplicate results obtained in pilot-plant operations. The coke-producing factor is being reduced to 1.0, equivalent to that of a clean catalyst. Iron, vanadium, and sodium concentrations have been markedly reduced in the catalyst returned to the cat cracker. Sufficient experience has not been recorded to permit a valid "before-and-after" comparison of the unit's effect on cat cracking operations when similar feed stocks were used. Fresh-catalyst makeup, however, has been well below that required before the unit was installed.

Insofar as product distribution and quality are concerned, it's believed that results are quite similar to those noted in pilot-plant operations. These were reported by W. J. Fowle, Atlantic engineer, at a Lake Placid meeting of the American Institute of Chemical Engineers last September (OGJ, Oct. 9, 1961, p. 72). Among the benefits reported were:

- Catalytic-coke yields (total coke yield, less cat-oil coke corrections) dropped from 3.3 to 2.5% when 11% of the catalyst load was Met-X treated.
- Hydrogen production dropped from 275 cu. ft. per bbl. to 125 cu. ft. when the process was used.
- Yield of agsoline (butane to 430° F. fractions) was improved by approximately 3%.

In officially opening the plant on November 28, Atlantic's President Henderson Supplee, Jr., described the process as a "major advance," and said that it would "substantially reduce the cost of catalytic cracking and increase the production of high-quality products from each barrel of oil." The company plans to make the process available by licensing.

Reference

(1) "How to Predict Contaminant Coke Yield," by H. R. Grane, J. E. Conner, and G. P. Masologites: The Oil and Gas Journal, June 5, 1961, p. 71.

ALUMINUM-PIPE HANDLING, welding, and laying sequence is simple because aluminum's light weight and easy-handling qualities. Welding of 6⅝-in.-diameter aluminum pipe (photograph at left) is done easily with an automatic pipe welder. Joints, easily handled by two men (photograph at right), are racked before feeding to the automatic welder.

What we're learning about aluminum

OVER 500 MILES of aluminum pipelines are now in service in the oil and gas industry in the United States, Canada, and South America; some buried, some on the surface, and others underwater.

Performance of aluminum pipelines demonstrates that aluminum pipe offers excellent resistance to corrosion, both to soil and to petroleum products, and that it is capable of being protected, when required, at a cost lower than competitive pipeline materials.

One of the earliest buried installations was made by Reynolds Metals Co. in 1949. Experimental installations followed this early pipeline including: underwater lines for tanker loading and offshore completion; buried lines for crude-oil gathering, gas gathering, water flood, and brine disposal; and temporary lines to work areas for water and fuel supply.

Aluminum pipelines receive wide consideration because of many basic advantages over other materials. These advantages are:

- Aluminum pipe can be extruded to exact design sizes, can be extruded with heavy ends, possesses a smooth inside diameter, and can be readily joined by welding, mechanical, or adhesive-bonding techniques.
- Light weight speeds stringing and handling of pipe during laying, permits use of lighter equipment and smaller crews.
- Aluminum is nonsparking under most service conditions.
- Over-all economy can be realized from reduced installation costs, longer life, and lower maintenance costs of a properly designed aluminum pipeline.

The first major pipeline was placed in service at Listerhill, Ala., in 1949. This pipeline is 8⅝-in.-o.d., alloy 6063-T6 manually welded using the TIG process with 4043 alloy weld wire. Except for one 40-ft. length of test pipe, the line was protected by a grease coat and paper wrap and by cathodic protection from magnesium anodes.

Anode system is at the midpoint in soil with a specific resistivity of 4,000 ohm-cm. Current of only 40 ma. polarizes the aluminum line to −1.1 volts as reference to a copper-copper sulfate electrode from a −0.77 volt natural potential.

An inspection in 1956 revealed no evidence of corrosion on either the exterior or the interior. The grease coating had completely disappeared and the paper overwrap, though intact, was loosely held to the pipe surface.

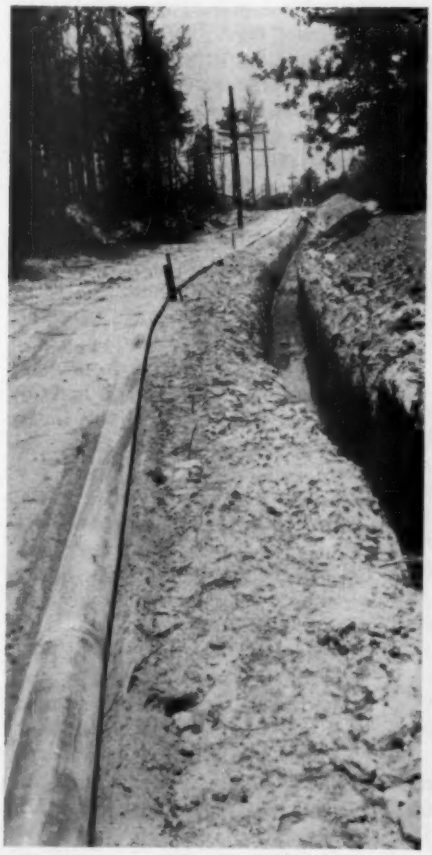
The unprotected 40-ft. joint of pipe (not wrapped and without cathodic protection) was in excellent condition and completely free of cor-

A **BULLDOZER** pulls the long welded sections of pipe into position.

pipelines

BY R. S. DALRYMPLE
Chief Corrosion Engineer,
Reynolds Metals Co.

Although introduced about a dozen years ago, today there are only about 500 miles of aluminum pipeline in service. We've learned that it offers excellent resistance to corrosion from both soil and petroleum products. When protection is needed, the cost is lower than competitive materials.



ROLLERS at the turns keep pipe out of the ditch while it is pulled through right-of-way.

COMPLETED STRING is lowered into the ditch and then backfilled.

Marine growths have no effect on corrosion resistance of aluminum

rosion, leading to the conclusion that neither wrapping nor cathodic protection would have been required to assure good performance without problems.

Coastal gas line. A gas line 8⅝ in. in diameter by 12 miles long laid in 1955 connected a plant to a gas-producing field. Protective coating is conventional coal-tar-enamel pipeline coating (cutback coal-tar enamel, primer, hot-applied enamel, glass-fiber insulating web, and 40-lb. kraft overwrap).

Also, the line is protected by sacrificial anodes at five points along the right-of-way.

Depending upon rainfall and seasonal factors, only 80 to 120 ma. (6.2 to 9.3 ma./mile) of current is required to cathodically protect this line. Soil conditions are very aggressive. The area which is near the coast is subject to salt-water intrusion. Conductivity varies from 250 to 500 ohm-cm. Nearby steel pipelines require as much as 30 amp. of protective current per mile of pipe.

Early in its life a section shorted out to an underground casing, thus isolating a section from the protective current of the sacrificial anodes.

A routine pipeline-potential survey noted that underground steel casing increased in potential from −0.45 to −0.89 volt, whereas the aluminum pipeline away from that area dropped off in potential from −1.1 volts to a value of −0.77 volt.

In less than 3 months' time, the pipeline perforated at a holiday in the protective coating, requiring a repair. Eliminating the pipeline casing short circuit and repair of the corroded area solved the problem. No additional corrosion failures have occurred in the last 6 years.

A little over a mile of line was removed from the ground, examined, and relocated during a plant expansion in early 1960. No evidence of severe corrosion of the exterior or interior was noted.

The aluminum line was designed using 0.96 "E" factor. Efficiency decreased only 6% in 6 years and that decrease occurred within the first 2 years. "Sanding" was largely responsible for the decrease because of a malfunctioning inlet filter. The line has not been pigged or otherwise altered to maintain its efficiency. Steel pipelines which supply the same plant are pigged on an annual or semiannual basis to maintain throughput.

Gathering system. A crude-oil-gathering system in Central Alabama is one of the largest installations of buried aluminum pipe. Pressures are sufficiently low that aluminum Schedule 5 Oil Country Pipe has the necessary mechanical properties.

Malleable-iron couplers connected the 500,000 ft. of 4-in. Schedule 5 pipe (0.083-in. wall) in 1956. No protection was employed either for the interior or the exterior of this line.

After 4 years of service, some sections of this thin-wall pipe failed by localized penetration where the malleable-iron coupler contacted the aluminum pipe. Failure was attributed to galvanic corrosion. Failed pieces of pipe were replaced and an additional 100,000 ft. of Schedule 5 aluminum pipe was put into the same field.

Pembina field in Canada has almost 80 miles of buried aluminum pipe in service handling a variety of products: water-flood water, oilfield brine, crude oil, and gas. These lines were examined at hot spots, as indicated by electrode-potential surveys, and found free from damaging attack. Where pitting was found, anodes or tape wrap plus anodes corrected a potentially corrosive condition.

Protection criteria. Field experience with buried aluminum pipelines has established that homogeneous soils with specific resistivity of 1,500 ohm-cm. or greater have almost no corrosive effect. Thus, in the absence of stray currents or galvanic factors many pipelines can be laid without wrapping except at discontinuities in soil type, at hot spots, or at pipeline crossings where interference may be encountered.

The only protection required may be from discreetly placed anodes or a combination of a few hundred feet of pipe wrap and locally applied cathodic protection.

Submarine Pipeline Corrosion

Factors influencing corrosion of submarine pipelines center around galvanic factors and solution chemistry. Discontinuities in sea-water or lake-water conditions are virtually absent, unlike subsoil applications.

Aluminum alloys 6061, 6062, and 6063 are resistant to sea water even in the splash zone. Data collected over some 30 years demonstrate that common aluminum-pipe alloys are not subject to uniform corrosion, but rather to local attack ranging up to 20 mils deep, and that attack does not progress.

Maximum pitting usually occurs during the first several years of service and then stops. Pitting mechanism is believed related to metallurgical structure of the 6000 series alloys. Small second-phase constituents corrode out, leaving small pits. Loss of these precipitates leaves a relatively pure, highly corrosion-resistant metal surface not subject to continuing attack.

In contrast, steel pipelines and structures are subject to more widespread and continuing corrosion particularly in highly oxygenated sea waters and in the splash zone. Aluminum is not aggressively attacked under the same conditions. It is employed to sheath and to replace steel pipelines and structures subject to splash-zone corrosion.

Marine growths have no effect on corrosion resistance of aluminum. Pipe samples exposed to sea water for periods up to 20 years have not developed corrosion under barnacles, oyster, or the more porous vegetable growths.

Experience indicates that unprotected aluminum submarine lines with a minimum wall section of 0.180 in. will resist penetration for over 30 years. Routine maintenance procedures will extend this excellent life expectancy.

If galvanic factors initiate more aggressive corrosion, anodes of aluminum, magnesium, or zinc can offer the required protection. The need for anodes is readily determined from routine potential studies.

Material costs for coating are the same as for steel pipelines

Cathodic Protection

Cathodic protection on aluminum was first described in the late 1920's and was done by mechanically applying a sacrificial aluminum alloy (alloy 7072 containing 1% Zn) to the inside of a small aluminum hot-water line.

Later, sacrificial aluminum alloy was metallurgically bonded to the aluminum core alloy by both rolling and extrusion process, providing a sacrificial anode where it would do the most good—right at the area subject to corrosion. Cladding makes possible routine use in aircraft of aluminum alloys that have low corrosion resistance but high strength.

Laboratory studies, and later field experience, have established parameters of cathodic protection for aluminum pipelines. Because aluminum is amphoteric, corrosion may be encountered in either acid or alkaline conditions. However, the protective oxide film on aluminum is stable over a rather wide range of pH values (pH 5 to 9).

These chemical properties of aluminum make overprotection, by application of electrical current, undesirable since overprotection will lead to formation of an alkaline condition at the cathode resulting in cathodic corrosion.

For aluminum pipelines, it is recommended that sufficient current be applied to polarize the pipeline to a value of −1.0 volt, referred to a copper-copper sulfate electrode. Potentials up to −1.2 volts can be tolerated safely but a potential of −1.4 volts has been known to set up cathodic corrosion in certain soils and in sea water.

Required current. How much current is required to protect a buried pipeline? The answer lies in the effectiveness of the protective coating (freedom from holidays), galvanic, or dissimilar metal contacts, and soil chemistry.

For steel pipelines, current densities of 1 to 2.5 ma. per sq. ft. area required to polarize the uncoated areas to a protected potential. This would mean an over-all current requirement of 12 to 30 amp. of current for 1 mile of uncoated 8⅝-in.-o.d. pipe.

Natural oxide on aluminum provides a barrier coating that greatly reduces protective-current requirements. In actual field studies in various aggressive soils (250 ohm-cm., high-salt soil) the current required to protect an uncoated aluminum pipeline 8⅝-in. o.d. was only 3 amp. per mile. This line had a native potential of −0.75 volt and was polarized to a value of −1.05 volts (all potentials referred to a $Cu/CuSO_4$ electrode).

Cathodic protection of buried aluminum pipelines applies well to submarine pipelines and structures. Potentials between −0.90 and −0.12 volt will provide cathodic protection to aluminum with a minimum of protective current.

Because sea water is an excellent conductor of electricity, the sphere of influence of an anode is reduced as compared to underground installations. This circumstance is more than compensated for by the protective oxide film on aluminum that acts as a barrier coating, bringing about a wider distribution of the protective current.

Cathodic protection of bundled aluminum submarine lines is done most economically by using the weighted line as the anode. The "grout line" or weighted line can be extruded to the required i.d. using a sacrificial aluminum-zinc alloy (5-6% Zn).

Wall thickness of the grout line will be in the range of 0.150 to 0.180 in. depending on various factors. If the grout line is 6 in. o.d. the weight of anode will be approximately 3 lb. per ft.

This amount of anode will provide 2,250 amp.-hours of protective current or enough to protect 100 sq. ft. of aluminum for nearly 50 years in sea water. This is an ample excess of sacrificial protection to accommodate inadvertent galvanic contacts, long line currents, or other special conditions.

Pipeline Coatings

Virtually all types of coatings have been tested on aluminum pipelines. All perform as well on aluminum as on steel. Gas pipelines have been protected with grease and a paper overwrap, and with conventional hot-applied pipeline enamels. Other lines have been wrapped, in part, using PVC or polyethylene tapes applied with or without primer as recommended by the manufacturer.

Material costs for coating pipelines are the same as for steel pipelines but two areas of economy exist:

1. Because of aluminum's lower friction factor a smaller-diameter aluminum pipe generally is possible than required for steel pipe. This means a smaller area to be coated.

2. The clean smooth surface of extruded aluminum pipe requires no brushing or sandblasting prior to coating application. This feature provides twofold economy: faster coating, and no surface preparation.

Prices for coating of aluminum pipelines are in the range of $0.13 per sq. ft. for tape wraps (primer, 14 mil PVC, 40-lb. kraft overwraps) to $0.24 per sq. ft. for hot-applied coal tars (prime coat, 3/32-in. coal tar, glass-fiber reinforcement, 40-lb. kraft overwrap). Prices vary on locality, i.e., freight rates, labor costs, and pipe size.

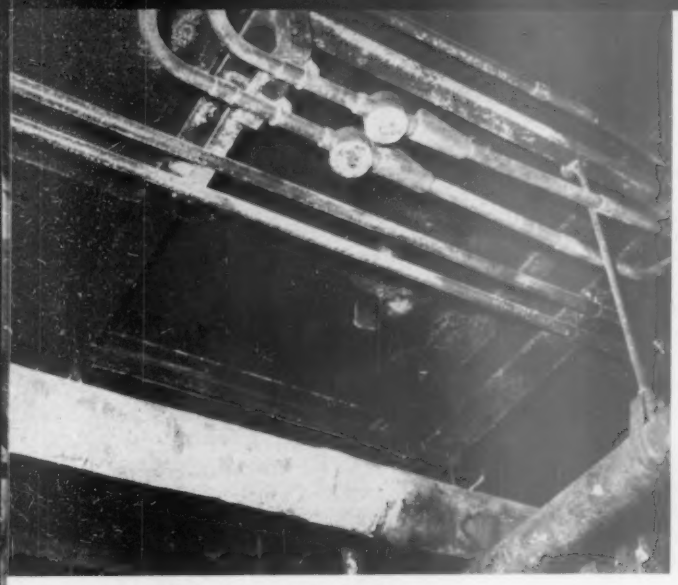
Aluminum Pipelines in Water

Excellent performance of aluminum in both sea and fresh water led to some interesting submarine applications. Probably the most extensive are found in Lake Maracaibo, Venezuela.

Test installations proved aluminum's ability to perform satisfactorily (OGJ, Sept. 14, 1959, p. 84). Pipelines are in flow systems linking producing wells to flow stations. Almost 25 miles have been installed since 1957. None have been subject to damaging attack.

Sea water. Probably the longest series of submarine pipelines, 50 miles of 2 and 3-in. plain-wall Schedule 40, alloy 6061-T6, is located in a crude-oil gathering system off the coast of Peru, installed in early 1961.

Large savings were realized as a result of the corrosion resistance and light weight of aluminum pipe. Careful design, particularly with respect to dissimilar metal contacts, will insure a long trouble-free life.



1. ORIGINAL CONDITION

2. SURFACE PREPARATION

Epoxy ester paint proved more durable than chorinated rubber material for protecting

Epoxy resin—versatile, valuable tool

BY R. H. BACON
Dow Chemical Co.

EPOXY RESINS as one of the more versatile of the modern plastics have proved to be one of the most valuable tools used by plant-maintenance people to combat corrosion of plant facilities.

Generally speaking, commercial epoxy resins of various molecular weights are produced by the reaction of epichlorohydrin and bisphenol-A. The low-molecular-weight resins, of less than 400-epoxide equivalent weight, are liquid, those of above 400-epoxide equivalent weight are solid.

Epoxy resins may be divided into two broad classes: (1) solid epoxy resins used in the manufacture of surface coatings, and (2) liquid epoxy resins used in laminating, castings, encapsulating, adhesives, etc. In actual practice liquid epoxy resins may be used to formulate coatings, usually high-build or about 10 mils and up. However, for the purpose of this article it is assumed that solid epoxy resins only are used in the formulation of surface coatings.

Solid Epoxies

Coatings based on solid epoxy resins are better known as: (1) catalyzed epoxy, (2) coal-tar epoxy, and (3) epoxy ester. Each type of formulation is best suited for a particular application.

Catalyzed epoxy using an amine catalyst has excellent resistance to chemicals, including nonoxidizing acids, brine solutions, and certain organic products. They have high temperature resistance, depending on the formulation, usually in the 250°-300° F. range. Formulations using a poly amid catalyst have less over-all chemical resistance; however, better color retention, flexibility, and application characteristics are imparted.

Coal-tar epoxy (also catalyzed) has similar chemical resistance with a higher temperature resistance, up to 400° F. It tends to embrittle with age and is available only in black.

Epoxy esters are competitive with oleoresinous coatings. However, they have good color retention, are easy to apply and have slightly better chemical resistance than the commonly known oleoresinous coatings.

Some case histories outlining a number of successful applications will better illustrate uses of formulated solid epoxy coatings.

Catalyzed epoxy, exterior of tank.

Problem: Protect exterior of 12 by 12-ft. tank from corrosion in a severe alkaline area.

Solution: Sandblast and apply an amine-catalyzed epoxy system to a finish-film thickness of 6 mils.

Result: This system, which was applied in 1953, gave excellent protection for 6½ years, outlasting previously applied chlorinated-rubber coatings more than fourfold.

Coal-tar epoxy, exposed steel deck.

Problem: Protect flat steel deck, about 300° F. heat, severe acid fumes atmosphere from nearby stack, and heavy foot traffic.

Solution: Sandblast and apply two-coat system to a finish-film thickness of 15 mils.

Result: In good condition, except for mechanical damage, after 2 years.

Epoxy ester, operating plant, organic area.

Problem: Protect equipment and piping in medium atmospheric corrosive area.

Solution: Compare epoxy ester paints with conventional oleoresinous coatings.

Result: After 3-year test period found equal to control coatings.

Job progress during a typical catalyzed-epoxy job using the airless spray method as shown in Figs. 1, 2, and 3. This area was painted

Presented at 1961 annual meeting of ASME, Petroleum Division, Kansas City, Mo.

3. FINISHED JOB

equipment and piping in a medium atmospheric corrosive area.

in plant maintenance

approximately 4 years ago with a chlorinated rubber system. Structural steel, floor plate, grating and conduit were galvanized. This is a three-coat system — total dry-film thickness is about 10 mils. Based on a 5-year life expectancy the cost per square foot per year will be 5.2 cents.

Liquid Epoxies

Laminates, castings, epoxy concrete, etc., based on liquid-epoxy resins were first used in our maintenance in early 1957. The first major job was lining a vacuum-blower casing used in salt-removal service for caustic evaporation. The efficiency of this machine was improved because of the ability to machine the cast epoxy material to close tolerance.

This application has given 2 years of service, equaling previous total life of casing without lining, and has since been reworked, again using epoxy. This type of work on brine and sea-water pumps alone will restore scrapped equipment to original factory tolerances, saving $1,500 to $2,000 in capital investment for each restoration (see Table 1 for typical formulation).

Here again, case histories will better illustrate how liquid-epoxy formulations can be successfully used as "tools" in plant maintenance.

Table 1—Typical Liquid Epoxy Formulation

Liquid-epoxy resin	100 Parts
Diethylene Triamine	10 PHR*
Flexibilizer	5- 10 PHR
Silica Flour	2- 3 PHR
Asbestos fiber	2- 5 PHR

*PHR: Parts (wt.)/100 parts of resin (wt.)

Repair of product lines.

Problem: Leaks in hydrogen lines—repair by welding would necessitate shutdown and purge of system.

Solution: Cleaned surfaces adjacent to leaks with solvents, used liquid epoxy formulation and glass cloth (7.36-oz. Volan treated), wrapping repaired line while in service.

Result: Added 2 years life to lines before general replacement was necessary.

Lining of tank.

Problem: Protect interior steel surfaces of tank for Versenes service. Operating temperature ambient. Previously lined with baked phenolic.

Solution: Sandblast to white metal and apply liquid epoxy formulation. spraying chopped-glass fibers into wet coat and packing by rolling smooth with paint roller; when dry to touch apply same formulation filled to a "grout" consistency.

Result: After 2 years of service, lining in good condition.

Lining of evaporator.

Problem: Protect interior steel surfaces of evaporator with top operating temperature of 200° F. and a pH of as low as 2. Previously coated with a baked vinyl.

Solution: Sandblast to white metal and apply liquid epoxy formulation, laying in by hand a laminate of glass cloth (7.36-oz. Volan treated). When dry to touch apply same formulation filled to a "grout" consistency.

Result: After 2 years service, lining in good condition.

Jacket-insulated towers.

Problem: Find an inexpensive method to maintain plant color scheme and reduce cost of insulation repair.

Solution: Apply a single, blue-green pigmented, liquid-epoxy laminate. This was done at approximately 50% of the cost of aluminum sheathing.

Result: After 1½ years, no insulation repair for painting necessary.

Miscellaneous applications. Other successful applications include grouting bolts on equipment, repair of concrete floors in hydrochloric acid areas, lining of condenser heads, fabrication of pump impellers, lining tank in sulfuric acid service, and repair of cracks in brick walls and foundations.

Cost Comparison

Costs of epoxy work, as in all corrosion-control applications, varies greatly according to the degree of corrosion present, complexity of surface, choice of materials, working conditions, etc. In general, epoxies as coatings are high in proportion to the more conventional methods, while as castings, laminates, etc., they may be much lower than conventional methods. Those persons responsible for selection of materials should be aware of the limitations of the epoxies and carefully evaluate each recommenda-

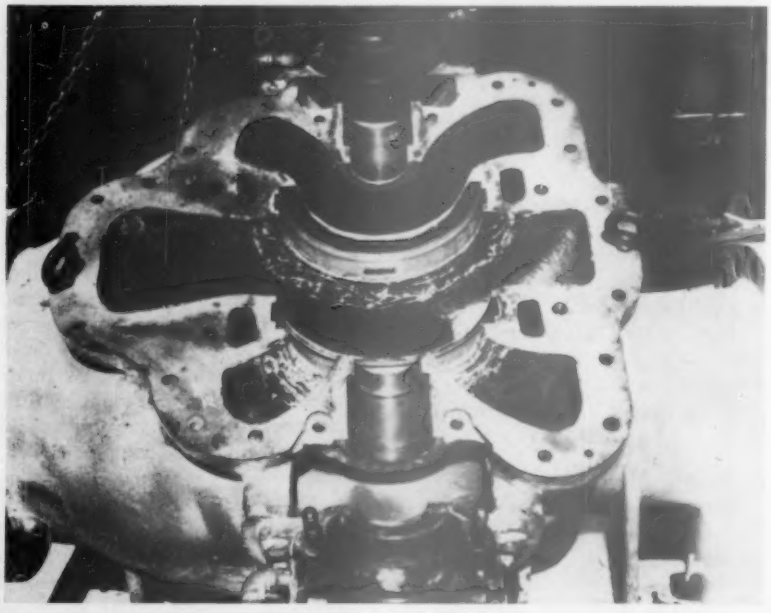
Table 2—Relative Cost of In-Place Job

Epoxy system—	Film thickness	Cost
Epoxy ester	6	1.0
Catalyed epoxy	7	1.25
Coal-Tar epoxy	16	1.75
Catalyzed epoxy	15	2.0
Epoxy laminate	70	2.5

BEFORE

Liquid epoxy was used to repair this sea water pump. Note severe cavitation on seal ring groove surfaces in Fig. 4.

AFTER



tion as to its cost and ability to perform the job.

In Table 2, we have a comparison of the relative costs within the epoxy field. All cost items for an in-place job are included. The costs were obtained by averaging a number of actual jobs, using a representative cross-section of different manufacturer's proprietary products. By assigning the value of unity to the system having the lowest comparable cost and dividing all others by this figure, we have calculated the relative costs of other systems.

It is obvious from a study of these costs that a factor in determining the least expensive is missing. Table 3 provides the missing factor—the service life of the system.

Using the same costs as found in Table 1 and dividing by the expected service life in years, we have expressed the relative cost per square foot per year of each system. These costs are applicable only when the corrosion engineer has specified the proper system for the particular situation.

TABLE 3—RELATIVE COST OF IN-PLACE JOB

Epoxy system—	Cost	Service	Cost/year
Epoxy ester	1.0	4	0.25
Catalyzed epoxy	1.25	5	0.25
Coal-tar epoxy	1.75	5	0.35
Catalyzed epoxy	2.0	7	0.3
Epoxy laminate	2.5	10	0.25

Safety Aspects

Due caution should be exercised in the handling of epoxy resins, curing agents (catalysts, hardeners) and solvents. No general toxicity problems exist with the resins themselves; however, contact over long periods of time may cause sensitization of the skin. Symptoms may develop after a variable time of working with the resins. Such skin trouble is never serious and the condition clears promptly after removal from the exposure, but once sensitized, the individual becomes ultra-sensitive to the resin.

Liquid-epoxy resin and solutions of the solid-epoxy resin are considered to be more irritating and, thus, one should be particularly careful to avoid contact.

Amine-curing agents are capable of causing serious irritation upon contact, particularly of the eyes and respiratory tract. Here again sensitization may occur.

Solvents used in epoxy formulations are flammable and toxic. Ketones and acetones are the more common solvents for epoxy.

Conclusions

The use of epoxy-resin formulations has been discussed to some extent by means of case histories and typical jobs. Safety problems involved in the use of epoxy formulations were described. The cost of applied jobs was outlined. The most important conclusions are as follows:

1. Epoxy resins are valuable tools in plant maintenance. They have varied uses.
2. When used as coatings, intelligent selection of systems will result in favorable cost comparison.
3. The greatest area of cost savings is found in the use of liquid-epoxy formulations as castings, laminates, etc.
4. Testing under plant conditions peculiar to each situation should precede general use of standard or tailor-made formulations.
5. Safety problems exist; however, common-sense safety rules will prevent harmful results to personnel.

Single action Colt owned by early Texas Ranger

Maintenance often meant the difference . . .

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New low-solids polymer mud cuts drilling costs for Pan American

The polymer is a cheap means of keeping mud solids at a low level, thus lengthening bit runs, speeding drilling rate, and cutting costs. While it extends the yield of bentonite, the polymer flocculates native drilled solids. Result is that solids content can easily be kept between 3 and 6% by volume.

BY J. L. LUMMUS, J. E. FOX, JR., AND D. B. ANDERSON
Pan American Petroleum Corp.

DRILLING RATES have been speeded, mud and chemical costs cut, and bit runs lengthened in more than 50 wells as a result of using a low-solids mud prepared with a new high-molecular-weight polymer.

The polymer is a unique chemical that reacts differently with various clays in drilling mud. While the polymer doubles yield of bentonite, it flocculates native clays. It is effective in preparing and maintaining drilling fluids with a total clay-solids content as low as 3 to 6 vol. %.

In one five-well test program for Pan American Petroleum Corp., the polymer cut drilling time as much as 43% and number of bits by 76%. Average clay-solids content was cut from 14 to 3%. This reduction in clay solids and use of chert bits were the major factors in reducing drilling costs.

The polymer can be used to prepare all types of low-solids muds—lime, gyp base, etc. Only limitation is that the mud cannot contain more than 1.5% salt.

Mud-pump pressure is lower when the polymer is used; friction losses for turbulent flow in pipe are less in fluids containing the material.

Rapid cut in costs. From 1958 through 1960, average mud cost per foot for Pan American was cut

1. Drilling with lower-density, high-fluid-loss muds.
2. Use of reclaimed mud.
3. Improved viscosity-reducing additives.
4. Wider use of low-solids mud.
5. Drilling with clear water or air and gas.

This downward cost trend should continue since mud technology, particularly in low-solids mud, continues to be refined and improved. Low-solids muds increase bit life and drilling rates. Result is lower drilling costs.

There is nothing mysterious in the way low-solids muds (3 to 7% solids by volume) reduce drilling costs. The cutting action of a rock bit is hindered by dispersed solids in the drilling fluid. The fewer solids the faster the drilling rate.[1,2]

Simplest way to keep solids content low is by diluting with water. Unfortunately, dilution harms other desirable properties such as fluid loss and cutting-carrying capacity. Basically, an effective low-solids mud must be one whose viscosity and fluid-loss can be controlled over a wide range to keep the hole stable.

The new polymer* can prepare 37%. This reduction results from several factors, including:

low-solids muds having widely varying properties.[2] The polymer is effective because it reacts differently with the various clays in drilling mud. The yield (bbl. 15-cp. mud/ton of clay) of bentonite, for example, is approximately doubled. Native clays, on the other hand, are either prevented from being dispersed or, if already dispersed, are flocculated. As a result of this dual function, this new additive can prepare and maintain low-solids muds having properties normally associated with higher-solids-content muds.

The polymer is effective in all types of drilling fluids, except those containing more than 1.5% sodium chloride. It has been used extensively for preparing gel-chemical, gyp, and lime-base muds.

Field tests

Low-solids muds prepared with the polymer have been tested under wide conditions in several areas. With few exceptions, proper use of the polymer made muds of lower clay solids content and permitted faster drilling. In some areas mud costs have been reduced but the more significant results have been the lower drilling costs.

Table 1 is a summary of results with low-solids, polymer-treated muds in several areas. More specific results are given in Tables 2 through 6.

The tests in Wood County, Texas, are particularly significant because they were closely supervised. Table 2 shows the results.

Presented at 1961 annual meeting of AAODC, Houston, under title, "Low-Solids-Polymer Mud Reduces Drilling Costs."

*Sold under the trade name of Ben-Ex by Rotary Drilling Services, Inc., through Cherokee Laboratories, Inc.

Although two contractors were used in drilling the five wells, the rigs were similar. Drill pipe and collars were identical. The same types of bits were used but were scheduled differently. Weight on bit and rotary speed were also varied depending on the type of bit used. Also, as the contractors gained experience in this area they could better schedule bits depending on changes in formation.

The experience factor no doubt contributed to the lower drilling costs on the last four wells. However, the two most important factors in speeding drilling rates, lengthening bit life, and cutting mud costs were better programing of bits and the low-solids, polymer-treated mud.

Most significant contribution was made by the polymer mud. It made

Table 2—Drilling on five wells in Wood County, Texas
From intermediate casing to top Smackover (5,200 to 12,800 ft.)

Well No.—	1	2	3	4	5
Type of mud—	Gel-chemical gyp base	Low-solids-polymer	Low-solids-polymer	Low-solids-polymer	Low-solids-polymer
Mud solids (approx. %)	13-15	7	5	3-4	2-3
Rig-days	76.6	70	61.5	46	48
Bits, total	124	103	76	40	30
No. R-1 bits	13	9	12	14	16
Rotating hours	1,135.75	884.5	1,019.5	867	852
Rate, ft./hr.	6.67	8.65	7.5	8.71	8.97
Rate, ft./bit	55	74.2	101	188.8	255
Total mud cost	$24,478	$16,222	$15,205	$21,645	$20,086

Table 3—Improvement in drilling rate using polymer-treated mud and chert bits

Well No.—	1	2	3	4	5
No. bits	10	9	11	14	16
Reruns	4	1	1	0	0
Footage	1,195	1,303	2,277	3,956	4,443
Hours	289.75	198	399.5	618.25	657.25
Ft./hr.	4.12	6.58	5.7	6.4	6.8
Ft./bit	119.5	145	207	283	278

Table I—Summary of results obtained using low-solids, polymer-treated drilling fluids

Area—	Mud type	Interval drilled, ft.	Rotating hours	Total rig-days	Number of bits	Mud costs, dollars	Total depth, ft.
San Juan County, New Mexico	Low-solids-polymer	5,509	161.5	13	12	1,422	5,718
San Juan County, New Mexico	Low-solids-polymer	5,379	124.75	12	12	1,075	5,737
San Juan County, New Mexico	Gel-chemical	5,437	169	14	11	1,728	5,672
San Juan County, New Mexico	Gel-chemical	5,370	165.25	..	11	1,727.30	5,580
San Juan County, New Mexico	Low-solids-polymer	878	64.25	11	4	1,090	5,150
San Juan County, New Mexico	Low-solids-polymer	....	....	11	..	1,131	....
San Juan County, New Mexico	Gel-chemical	358	27.75	13	2	1,789	4,818
Palo Pinto County, Texas	Low-solids-polymer	3,696	167	..	14	....	....
Palo Pinto County, Texas	Low-solids-polymer	....	184	10.5	12	1,061.08	4,094
Palo Pinto County, Texas	Gel-chemical	3,666	305	..	14	....	....
Alberta, Canada	Low-solids-polymer	4,265	604.75	54	54	8,799.68	11,029
Alberta, Canada	Gel-chemical	4,302	768.25	59	55	11,380.02	11,164
Alberta, Canada	Gel-chemical	4,315	640.0	53	52	8,319.24	11,057
Andrews County, Texas	Low-solids-polymer	1,885	227.75	40	14	11,820	11,030
Andrews County, Texas	Low-solids-polymer	2,380	251.25	44	18	16,451	10,705
Andrews County, Texas	Low-solids-polymer	....	....	40	..	7,937	10,915
Andrews County, Texas	Gel-chemical	3,680	394.0	49	26	19,809	11,030
Andrews County, Texas	Low-solids-polymer	....	....	58	..	10,842	13,030
Andrews County, Texas	Low-solids-polymer	....	....	45	..	9,235	12,461
Andrews County, Texas	Low-solids-polymer	....	....	46	..	8,646	12,591
Andrews County, Texas	Low-solids-polymer	....	....	40	..	5,226	12,010
Wood County, Texas	Low-solids-polymer	7,600	884.5	70	103	16,222	13,268
Wood County, Texas	Low-solids-polymer	7,600	1,019.5	61.5	76	15,205	13,264
Wood County, Texas	Low-solids-polymer	7,600	867	46	40	21,645	13,375
Wood County, Texas	Gel-chemical, gyp base	7,600	1,135.75	76.6	124	24,478	13,524
Grant County, Kansas	Low-solids-polymer	1,136	84.75	..	7	429	5,950
Grant County, Kansas	Gel-chemical	1,234	106.5	..	10	480	6,060
Swan Hills, Canada	Low-solids-polymer	7,756	268.25	20	22	2,261.77	8,386
Swan Hills, Canada	Low-solids-polymer	7,834	301.25	25	20	2,409.05	8,454
Swan Hills, Canada	Low-solids-polymer	8,094	262.25	23	23	2,554.62	8,727
Swan Hills, Canada	Low-solids-polymer	7,764	301.75	30	28	2,224.77	8,382
Swan Hills, Canada	Gel-chemical	7,925	315.4	24	24	2,057.66	8,545
Palo Pinto County, Texas	Low-solids-polymer	....	184.5	12	11	1,629.76	4,200
Palo Pinto County, Texas	Gel-chemical	....	274.5	15	18	2,923.84	4,262
Ochiltree County, Texas	Low-solids-polymer	4,703	340.5	28	24	....	7,915
Ochiltree County, Texas	Gel-chemical	4,350	333.5	28	25	....	7,550
Texas County, Oklahoma	Low-solids-polymer	4,182	228.25	14	18	3,771.59	6,145
Texas County, Oklahoma	Gel-chemical	3,963	259.25	16	18	3,723.72	6,152
Morton County, Kansas	Low-solids-polymer	4,061	192.25	14	14	2,582.57	5,680
Morton County, Kansas	Gel-chemical	3,851	248.0	20	14	2,153.82	5,636

possible use of chert or button bits for both hard and soft formations. Table 3 shows the improvement in drilling rate in wells 2, 3, 4, and 5 using the polymer-treated mud and chert bits.

Aid to bits. Wells 1 and 4 are specific examples of the effect of the polymer mud in increasing effectiveness of chert bits for drilling shale. Table 4 shows partial bit records from these wells.

In well 1, the first chert bit used drilled from 8,415 to 8,474, a total of 59 ft., in 12 hours. On well 4, the first chert bit was used from 8,396 to 8,567, a total of 171 ft., in 31.5 hours. Six bits, including one chert type, were required in well 1 through the interval drilled with one chert bit in well 4. Drilling rate over the interval in well 1 was 4.92 ft. per hour. In well 4, it was 5.43 ft. per hour.

Longer bit life cuts trip time, thus further reducing costs. Six trips were made on well 1 over the interval. One trip was made on well 4. Assuming 5 hours per round trip at this depth, 1 day was saved.

Comparing muds. Table 5 summarizes mud properties for the five wells drilled in Wood County, Texas.

A conventional gel-chemical mud was used in well 1; this mud was converted to a gyp-lignosulfonate type before drilling the massive anhydrite topped at about 7,500 ft.

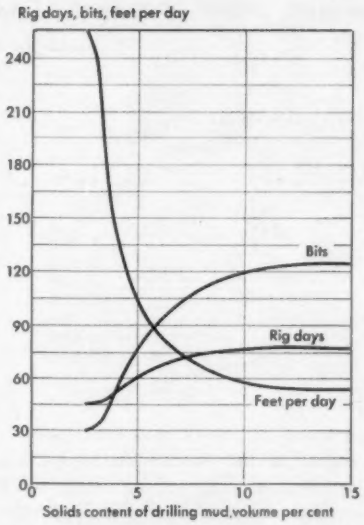
A low-solids polymer mud was used in drilling the other four wells. It was not converted to a gyp-base mud. The mud was lightly treated with caustic and lignosulfonate for good flow while drilling the massive anhydrite. Oil content of the mud for all wells was similar, ranging from 0 to 10% (by volume) on each well.

Mud properties shown in Table 5 for well 1 are typical this area before use of the polymer-low solids system. Viscosity of the low-solids-polymer muds was kept slightly lower than that of the mud used in well 1. Even with the lower viscosities of the low-solids-polymer muds, hole conditions were excellent. There was little or no fill noted on trips.

Fluid loss of the low-solids-polymer system was not maintained at a specific amount but was allowed to fluctuate over a wide range, 15 to 60 cc. per 30 minutes.

Mud weights were lowered from ½ to 1 lb. per gal. with the lower solids content. In well 2, the first well drilled using the low-solids-polymer mud, average solids content (by volume) was reduced 50%. On subsequent wells, solids were further reduced due to better application of the polymer.

Fig. 1 shows how solids affected number of rig-days, number of bits, and feet per bit. Cutting solids from 15 to 7 vol. % reduced, but only slightly, number of bits and rig-days. Feet per bit increased. This trend continued as solids were further cut from 7 to 5 vol. %. Cutting solids from 5 to 3.5 vol. % made the largest increase in the feet per bit and the greatest decreases in the rig-days and number of bits.



COST GOES UP with solids content of the drilling fluid. Presence of solids in hole hinders cutting action of the bit. As a result, a bit can't drill so fast nor so far when many solids are present. Number of rig-days depends directly on number of bits (and round trips) and drilling rate. Fig. 1.

Palo Pinto County, Texas. A series of tests in Palo Pinto County, Texas, provides another example of the effect of the low-solids-polymer mud on drilling. Three wells were drilled in this area. The first used a gel-chemical mud. The other wells used the low-solids polymer mud. Table 6 compares drilling for the three wells.

On well 1, drilled with a gel-chemical mud, and on well 2, the first well drilled with the low-solids-polymer mud, the same number of bits was used to drill about the same footage. However, rotating hours on well 2 were 50% lower than on well 1. On well 3, number of bits was cut slightly although more footage was drilled as compared to wells 1 and 2.

The penetration rate, in feet per hour, was almost doubled on the wells using the low-solids-polymer mud (wells 2 and 3). The number of feet per bit on wells 1 and 2 were the same. The footage per bit increased slightly on well 3.

The average number of hours required per bit to drill this footage

Table 4—Partial bit records from wells 1 and 4, Wood County, Texas

Well No.	Interval drilled	Bit type	Feet	Rotating hours	Ft./hr.
1	8,401-8,415	Hard rock	14	3	4.67
1	8,415-8,474	Chert	59	12	4.92
1	8,474-8,493	Hard rock	19	4.5	4.22
1	8,493-8,512	Hard rock	19	4.75	4.0
1	8,512-8,534	Hard rock	22	4.25	5.18
1	8,534-8,588	Hard rock	54	9.5	5.68
	Total		187	38.0	4.92
4	8,396-8,567	Chert	171	31.5	5.43

Table 5—Average mud properties on wells in Wood County, Texas

Well No.	Mud weight, lb./gal.	Funnel visc. seconds	Fluid loss, cc./30 min.	Oil, % vol.	Solids (approx.) % vol.
1	9.5-10.3	35-40	10-20	0-10	13-15
2	0.9-9.2	30-35	20-40	0-10	6-7
3	9.0-9.2	30-33	20-30	0-10	5-6
4	8.9-9.1	20-31	15-40	0-10	3-4
5	8.9-9.1	29-31	15-60	0-10	2-3

Table 6—Comparative drilling data on wells drilled in Palo Pinto County, Texas

Well No.—	1	2	3
Mud type	Gel-chemical	Low-solids polymer	Low-solids polymer
Feet of hole	3,666	3,696	4,094
Rotating hours	305.25	167	184
Bits	14	14	12
Feet/hr.	12	22.1	22.3
Feet/bit	262	264	341
Hours/bit	21.8	11.9	15.3

was much lower on the wells using low-solids polymer drilling fluid.

Table 7—Effect of salt on a low-solids-polymer mud

Base mud: 14 lb./bbl. bentonite
10.5 lb./bbl. low-yield clay
0.05 lb./bbl. polymer
0.25 lb./bbl. soda ash

Sodium chloride added p.p.m.	Plastic viscosity cp.	Yield value lb./100 sq. ft.	Fluid loss cc./30 min.
0	12	49	13.5
1,000	10	63	13.7
5,000	8	62	15.9
7,000	8	61	...
10,000	7	63	16.4
15,000	7	58	...
20,000	7	55	21.9
30,000	5	44	36.2

Field Preparation and Maintenance

Following are some guides for preparing and maintaining low-solids-polymer treated muds. When prepared in the following manner, you may expect initial fluid loss to vary between 10 and 30 cc. per 30 minutes and the viscosity from 35 to 45 seconds per quart.

Preparation

1. Clean pits and fill with the required amount of fresh water.
2. Add the polymer through the hopper to the mixing water to obtain a concentration of not more than 0.05 lb. per bbl.
3. Add bentonite slowly through the hopper until the concentration of bentonite reaches 3% by weight or 10.5 lb. per bbl.
4. Add soda ash through the hopper until a viscosity of 35-40 seconds (Marsh funnel) is obtained. Optimum concentration of soda ash is 0.25 lb. per bbl. to 0.5 lb. per bbl. if good-quality bentonite is used.
5. After the polymer, bentonite, and soda ash have been well dispersed, the mud system may appear fluffy. Adding 0.1 lb. per bbl. caustic and 0.1 lb. per bbl. quebracho eliminates this effect and reduces fluid loss.
6. Add 5 to 10% oil by volume if an emulsion mud is desired.

Maintenance

1. Polymer used for maintenance should be added through the chemical barrel. To prepare a water solution, sift the polymer slowly into a water spray directed into the chemical barrel. Dissolve 2 lb. of polymer into 40 to 50 gal. of water. Addition of 2 lb. of polymer per tour or 6 lb. per day is recommended.
2. Add 5 to 10 sacks of bentonite per tour along with a small amount of caustic and quebracho to maintain the mud and inhibit dispersion of drill solids. Keep solids in the range of 3 to 6% by water dilution, jetting, and cyclone treatment.
3. Pretreat the system with soda ash or bicarbonate of soda when preparing to drill cement.
4. Pits should be jetted once per tour.

Miscellaneous Comments

1. Except for using smaller amounts of viscosity-reducing agents, treat polymer muds as a conventional, gel-chemical mud system.
2. If a system should be inadvertently overtreated with bentonite and polymer, the viscosity may be returned to normal either by dilution or by addition of small concentrations of viscosity-reducing agents.
3. Use thinners cautiously as polymer muds respond to light treatment. This factor should be brought frequently to the attention of personnel concerned with mud maintenance. A typical polymer mud requires 30 to 40% of the chemical treatment normally required for gel-chemical muds.
4. Drilling rates are best when percentage of mud solids is kept low as possible.
5. The polymer does not function in water containing an appreciable quantity of salt. For example, the polymer begins to lose its effectiveness in water containing more than 1.5% sodium chloride. As a general rule, the polymer may be used in any water in which bentonite satisfactorily disperses.
6. The polymer accelerates yield of bentonite. This trait may be used to advantage in mixing batches of viscous mud for placement of lost-circulation materials.
7. A polymer-treated mud may be converted to any type of system.

Laboratory Observations

Table 7 shows how salt contamination affects a laboratory-prepared polymer-low-solids mud.

Adding 1,000 p.p.m. salt increased the Faun value of the mud from 49 to 63 lb. per sq. ft. with only a slight change in the plastic viscosity and fluid loss. Further additions of salt, up to 10,000 p.p.m. had only slight effect on the mud. However, when the salt contamination increased to 30,000 p.p.m., fluid loss more than doubled and the plastic viscosity and yield value were reduced.

Gyp contamination. On a well in Eddy County, New Mexico, bentonite could not effectively increase viscosity of the mud, which contained 4,500 p.p.m. chloride and 280 p.p.m. calcium. This field mud

Table 8—Effect of polymer on properties of a gyp contaminated field mud

Chloride concentration: 4,500 p.p.m.
Calcium concentration: 280 p.p.m.

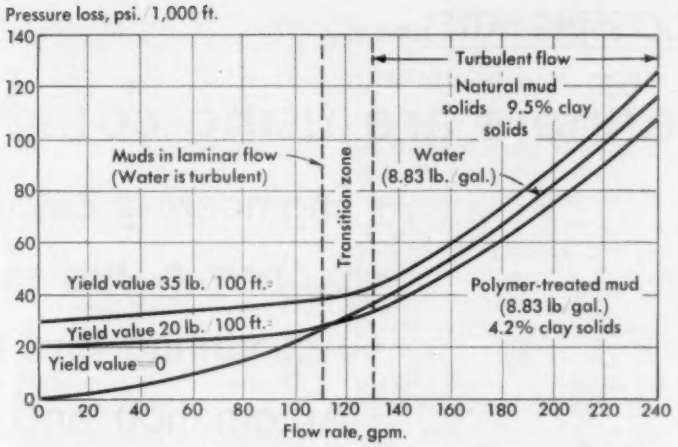
Polymer conc. lb./bbl.	Bentonite added lb./bbl.	Plastic viscosity cp.	Yield value lb./100 sq. ft.	Fluid loss cc./30 min.
0	0	23	8	3.7
0.05	0	23	8	3.0
0.05	1	27	9	4.0
0.05	1.5	30	11	3.6

was sampled and forwarded to the laboratory for testing. Results of the tests are shown in Table 8.

Adding of 0.05 lb. per bbl. of the polymer had no effect on viscosity. However, when bentonite was added along with the polymer, viscosity did increase. Addition of 0.05 lb. per bbl. of the polymer and 1.5 lb. per bbl. bentonite increased plastic viscosity from 23 to 30 cp. and the yield value from 8 to 11 lb. per 100 sq. ft. Fluid loss did not change appreciably when polymer and bentonite were added.

Effect on hydraulics. Large-scale flow tests were made on the effect of polymer treatment on the flow properties of muds in pipes of various diameters. We developed conventional pressure drop-flow rate relationships for various drilling fluids under both turbulent and laminar flow conditions. Table 9 shows properties of the drilling fluids tested.

Fig. 2 plots pressure loss against flow-rate plot for water, a polymer-treated fluid, and a natural mud. The pipe used for flow tests was 3½-in. internal flush. For comparison, the curves in Fig. 2 were corrected to a common density of 8.83 lb. per gal.



IT PUMPS EASIER THAN WATER. Low-solids, polymer-treated mud has less pressure loss in turbulent flow than does water in flow through pipes. This means that mud-pump pressure will be lower to pump the same volume. Or, the same pump pressure can be used to displace a greater volume through smaller jet-bit nozzles. Fig. 2.

In the region of turbulent flow, the polymer-treated fluid (curve 1) showed lower pressure drops than clear water or a natural drilling mud (curves 2 and 3). Turbulent-flow friction is lower when circulating the polymer-treated mud because of a property called "viscosity"[3] which the polymer imparts to a fluid. The difference in the clay-solids concentration of the drilling fluids (amounting to 5.3%) would account for less than 5% of the friction-loss reduction.

As an example of the effect of the polymer in reducing friction losses in a drilling-rig flow system, let us assume we are drilling at 6,600 ft. in 6¾-in. hole. Say we have 6,000 ft. of 3½-in. 15.50-lb. IF drill pipe and 600 ft. of 2¼ in. i.d., 5¾ in. i.d. collars. Assume our fluid weighs 8.85 lb. per gal. standard to eliminate all mud-density effects. We are calculating 240 g.p.m. for 175-ft. per minute annular velocity. Our surface equipment is "Case 3" in the Hughes hydraulic tables.

Table 10 shows the effect of the polymer on friction losses, based on the above assumptions.

This example shows that a low-solids polymer-treated mud in place of a natural mud would reduce friction losses by 27%. A rig-hydraulics program could be planned to use this effect to good advantage. For example, more fluid could be pumped through a jet bit with a pressure drop lower than normal for conventional drilling muds. Or, smaller bit nozzles could be used without increasing pressure.

Table 9—Properties of muds used in pipe flow tests

Fluid	Water	Natural mud	Treated mud	Polymer mud	Chemically treated polymer mud
Weight	8.32	8.83	8.73	8.55	8.45
Funnel viscosity	26.8	71	54	53	49
Plastic viscosity	1	19	21	14	13
Yield value	0	35	12	20	13
% Clay solids by weight	0	9.5	9.1	4.2	4.0
% Oil by volume	0	0	5	0	5
Chemicals	None	None	(*)	(†)	(‡)

*1 lb./bbl. modified lignosulfonate, 0.3 lb./bbl., NaOH. †0.05 lb./bbl. polymer, 0.25 lb./bbl., soda ash. ‡0.05 lb./bbl. polymer, 0.25 lb./bbl. soda ash, 0.1 lb./bbl. modified lignosulfonate, 0.05 lb./bbl. NaOH.

Table 10—Effect of polymer on friction losses

Losses	Hughes tables§	8.83 lb. water	8.83 lb. low-solids polymer mud	Natural untreated mud
Through surface equipment	10	* 10	* 10	* 10
6,000 ft. 3½ IF	†821	‡702	‡648	‡762
600 ft. 2¼ i.d. collars	170	§170	§156	§178
600 ft. around collars	170	¶170	¶156	¶178
6,000 ft. around pipe.	‖ 79	** 72	††138	††210
Total exclusive of bit nozzles	1,250	1,124	1,108	1,338

*Assumed (minor). †3-cp. mud. ‡Actual results (Fig. 2). §Calculated from results in 2.067-in. i.d. pipe. ¶Assumed from line above. ‖Hughes assumed turbulent flow 3-cp. fluid. **Turbulent flow. ††Laminar flow—shear forces approximately equal to 68-g.p.m. rate on Fig. 2.

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Refiners are using computers in

- Engineering calculations
- Economic studies and matrix operation
- Accounting and operation monitoring
- Automation and process control

"THE OIL COMPANIES are spending more of their computing dollars in economic planning than in all other uses except possibly the accounting activity. This attention is justified because there is a very large profit potential in efficiently handling this aspect of refinery planning."

This trend in the practical use of digital computers was brought forth by Joe E. Dickson, of Bonner & Moore Engineering Associates, in a paper delivered at the sixteenth annual technical meeting of the South Texas section of AIChE in Galveston last month.

Dickson discussed four major divisions in the use of digital computers: engineering calculations, economic studies and matrix preparation, accounting and plant operation monitoring, and automation and process control.

Engineering calculations. Automatic calculations of basic engineering functions found in unit operations seems to be the optimal situation. A system called unit operations simulator was designed to make calculations for material balances, heat balances, and vapor-liquid equilibrium. The subroutines are coded within an interpretive system framework.

Economic studies and matrix operation. A mathematical model must first define the plant's economics to develop a system for economic planning which a computer can handle. Matrix generators can prepare the models. These generators are a powerful aid in preparing complex refinery simulations for economic planning.

Accounting and plant operation monitoring. Yield accounting should provide management with the current picture of material flow through the plant and emphasize raw material and product inventories.

A major error is to attempt a direct translation of the manually performed functions into a computer program. Instead, plant configuration is presented in the basic program which requires constant revision to make allowances for additions, changes, repairs, and turnarounds.

A new approach describes as input data the plant configuration, along with yield and inventory information. The interpreter type program the approach uses does three things. First, a minimum of computer knowledge is needed by those who use the program. Second, no stored programing techniques are used in the source program. Third, program execution is to read the card and then analyze and execute the statement on the card. The program can be changed by adding, deleting, or changing cards. The yield accountant prepares cards to modify the program to fit the current plant configuration and thus represent any step-by-step yield accounting procedure.

Automation and process control. Economic planning sets over-all plant strategy. Yield accounting tells how well this strategy is met. Now, consider a control computer that would compare the optimal results of economic planning with yield accounting and propose plant adjustments to bring yield accounting closer to optimum.

The flexibility of the digital computer is well suited to close the predict-measure-adjust loop.

The central computer could supply economic information to slave-control computers at the individual units. The slave computers would optimize the units they control based on information from the central computer.

New route to acetylene

Process being tested in Japan uses hydrocarbon-hydrogen feed to regenerative furnace

THERE ARE NOW about a dozen methods available for converting hydrocarbons to acetylene but research is continuing for better, cheaper routes.

A method currently being pilot-plant tested in Japan involves charging a hydrocarbon-hydrogen mixture to a regenerative-type furnace. There the hydrocarbons are pyrolytically cracked on alumina pebbles, at pressures only slightly above atmospheric.

Use of hydrogen as a diluent is said to be very effective in depressing the formation of tars and carbonaceous materials during the cracking reaction. Its use also ma-

terially improves the yield of acetylene, as compared with the use of steam as a diluent. In the latter case, steam reacts with the hydrocarbons at high temperatures to form CO and CO_2.

Early research on the process was carried out at University of Tokyo. Development on the pilot-plant scale, using feeds of methane, coke-oven gas, and other light hydrocarbons, is going on at the Industrial Research Institute. The project was described by T. Kunagi, University of Tokyo, at a recent meeting of the American Institute of Chemical Engineers in Lake Placid, N. Y.

An advantage pointed out by Kunagi is that the residual gas has very low concentrations of CO and CO_2. This would be quite desirable if the residual gas is utilized as a source of hydrogen.

Yield data. In bench-scale tests, using a methane cracking catalyst, one volume of methane was cracked with 3.9 volumes of hydrogen at a reactor temperature of about 2,500° F. Content of acetylene in the cracked gas was 6.5 by vol. %, representing 85% conversion of methane and an acetylene yield of 87.5% based on cracked methane.

Use of some steam was found to result in slightly higher yields. When the diluent stream was composed of 2 moles of hydrogen and 1 mole of steam, acetylene content of the cracked gas was increased to 6.7 vol. %.

The quenching effect of the alumina pebbles used in the regenerative furnace was found to be quite satisfactory. No carbon deposition was observed in the zone corresponding to temperatures above 875° F.

Since the concentration of acetylene in the cracked gas is relatively low, the separation of the products is carried out by a continuous adsorption process. Activated charcoal in multistage fluidized beds worked satisfactorily in pilot-plant tests.

Catalyst activity up in May-July period

SURVEY of equilibrium catalyst for the May-July quarter shows an increase in activity. This is a seasonal increase, however, and indicates that refiners are adding fresh synthetic catalyst to obtain maximum yields of gasoline.

Range of iron contamination has increased. This is traced to data supplied by two refineries which have been added to the survey. In one case iron contamination was substantially above the average; the other was substantially lower.

Other changes are too small to be significant.

Quality trends in equilibrium fluid cracking catalysts

(Based on Davison analyses of samples from over 55% of fluid units in the United States and Canada)

PERIOD	PRESENT QUARTER May-July 1961		PREVIOUS QUARTER Feb.-April 1961		YEAR AGO May-July 1960	
	Mean	Range*	Mean	Range*	Mean	Range*
Activity D + L	30.1	24.5-35.7	29.4	23.9-34.8	29.2	23.8-34.6
Surface area M²/gm.	119	58-179	120	68-173	119	68-170
Pore volume cc./gm.	.40	.27-.52	.39	.24-.53	.38	.25-.51
Apparent bulk density gms./cc.	.72	.64-.81	.72	.61-.83	.73	.62-.84
Metal contamination Vanadium, V: p.p.m.	208	46-940	200	45-900	162	35-755
Nickel, Ni: p.p.m.	84	17-409	83	17-409	67	15-314
Copper, Cu: p.p.m.	†23	6-92	†27	8-87	3	.4-31
Sodium, Na: p.p.m.	470	81-2,745	499	87-2,864	458	54-3,856
Iron, Fe: wt.%	.34	.08-1.46	.34	.11-1.08	.36	.12-1.10

*95% of fluid units tested fall within these limits. †New Copper method.

Sulfur content in fuel oils drops again

SULFUR CONTENT of fuel oils has declined again this year, continuing a long-range trend.

Nationwide average of No. 2 fuel oil is 0.286 wt. %. Last year it was 0.320 wt. %. Lowest-sulfur fuel oil was marketed on the East Coast where it averaged 0.228 wt. %. Highest average was registered on the West Coast where it was 0.419%. Across the nation, the figure varied between a low of 0.029 wt. % and a high of 0.93 wt. %. The figures are based on analyses of 186 samples.

Other tests on No. 2 show little change from last year. API gravity varied widely from a low of 26.6 to a high of 47.7, although the average of slightly over 35 was comparable to last year's figure.

Kinematic viscosity at 100° F. ranged from a low of 1.8 cs. to a high of 4.3 cs. Average was about 2.6.

No. 6. Here again the lowest-sulfur fuel was marketed on the East Coast. It averaged 1.34 wt. %. West Coast was high with a 1.91 wt. % average. The range varied from a low of 0.34 wt. % to a high of 4.0 wt. %. These data were based on analyses of 144 samples.

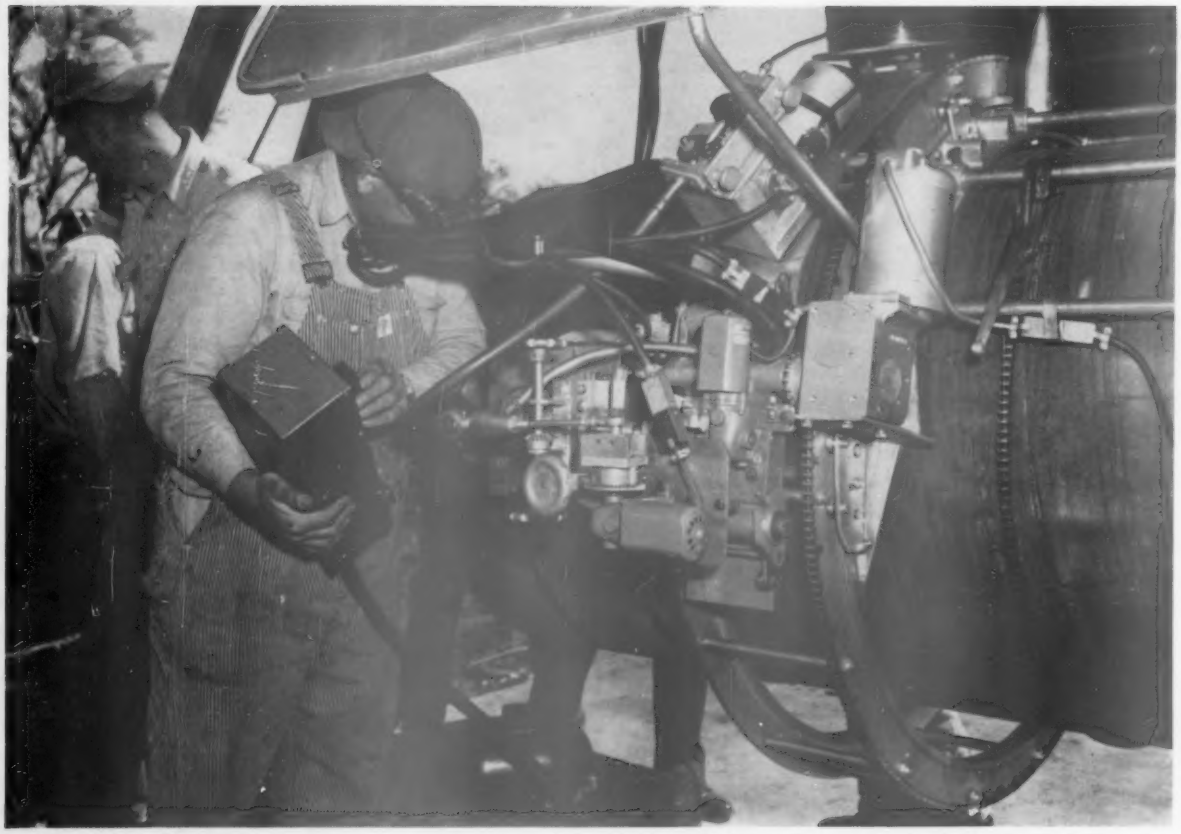
As usual, this grade showed considerable variation in most properties. The average, however, remained about the same as in past years.

Complete data on this survey of burner fuel oil properties are available in the Bureau of Mines booklet "Burner Fuel Oils, 1961."

UK will get first polyisobutylene plant

FIRST polyisobutylene plant in the United Kingdom will be built by W. R. Grace & Co. at Baglan Bay, South Wales. The plant, scheduled for completion late in 1962, will have an annual rated capacity of 8 million pounds, with molecular weights ranging from 600 to 2,000.

Feed stock, a mixed C_4 stream rich in isobutylene, will come from an adjoining plant being built by British Hydrocarbon Chemicals, Ltd.



THE AUTOMATIC WELDER was designed to be compact and light. The saddle bracket and rotating fixture are aluminum. This view shows the arc shield and the device for oscillating the wire feed tip. Fig. 1.

Now welding's being mechanized, too

Fully automatic process for big-inch and semiautomatic process for smaller-diameter pipe, tested under field conditions, shows lower cost, greater speed, and better welds than conventional methods.

BY B. V. ELLIOTT
H. C. Price Co.
W. B. HANDWERK
Crose-Perrault Equipment Co.
AND H. B. CARY
Hobart Brothers Co.

DEVELOPMENT of the small-wire CO_2 welding process, the specialized welding generators, and the automatic welding fixture has proved that welding can be mechanized as have other functions of pipelining.

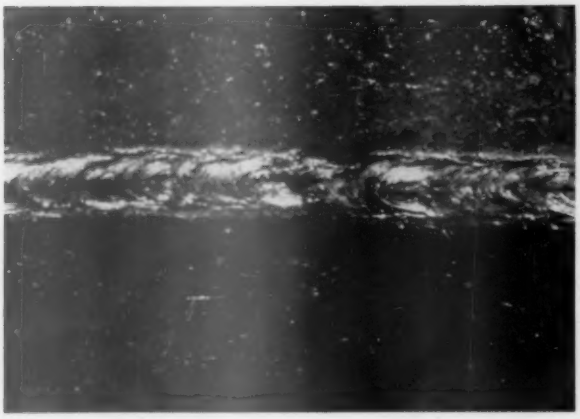
Adoption of the semiautomatic gas-shielded process to small-diameter pipelining indicates that manpower requirements can be drastically reduced. This alone created a sizable cost reduction and also shortened the spread and reduced the amount of equipment. High rates of laying pipeline resulted. The tests proved that the equipment could be used under extremely rugged field conditions.

Presented at 1961 AWS meeting, Dallas.

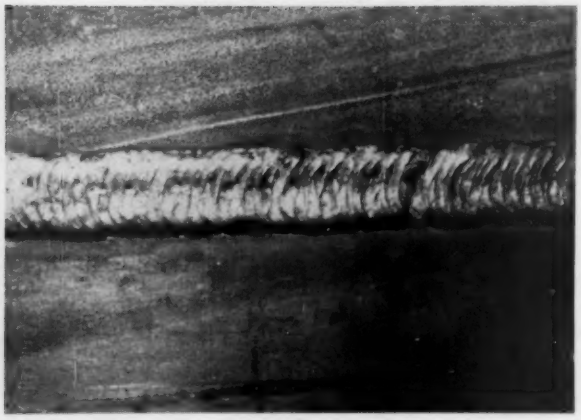
It was also indicated that savings for pipe somewhat larger than 6-in. but still not considered big inch could be further increased. It remains now for the pipelining industry to take full advantage of the semiautomatic gas-shielded process to effect further cost savings.

Field testing of the fully automatic apparatus revealed that mechanized welding could also come to big-inch pipelines. This type is much more complex and offers large potential savings.

The manpower reduction made possible by the automatic welder is appreciable. When coupled to the semiautomatic welder for initial passes this saving becomes greater. The plan to install additional welding heads on the automatic pipe welder and to further increase welding speed will make the automatic



INSIDE VIEW, root-pass, 36-in.-pipe, small-wire, CO_2 gas-shielded process. Fig. 2.



OUTSIDE VIEW of cover pass made on 36-in. pipe utilizing the automatic welder. Fig. 3.

welding of big-inch pipe very attractive.

Automatic Welding

Considerable time and money have been spent by the pipeline industry investigating semiautomatic and automatic welding processes. The conclusions indicate that the gas-shielded metal-arc welding process using CO_2 gas for shielding offered the most promise. It was determined that the semiautomatic microwire process could be successfully applied to automatic pipe welding. It embodies a consumable electrode wire continuously fed into the arc.

An automatic wire feeder coupled to a specially designed constant-voltage power source supplies the filler wire to a lightweight torch. The torch, held and manipulated by the operator, carries the welding current and electrode wire and directs the carbon dioxide (CO_2) shielding gas into the welding zone.

It uses an extremely small electrode wire usually from 0.030 to 0.045-in. diameter. The arc voltage is low and the welding current d.c. reverse polarity ranges from 100 to 200 amp. The process had the ability to bridge gaps but did not require higher skilled operators.

Uphill procedure. Pipe welds were made in the horizontal fixed position without the use of backing rings on small-diameter process piping. The uphill procedure was used but the total time was reduced nearly one-half that of manual-covered electrode welding. These welds met the ASME Boiler and Pressure Vessel Code.

The gas-shielded small-wire process had been used for automatically roll welding large-diameter pipe. This was performed entirely from the outside of the pipe and was carried out without the use of a backing ring. The joint utilized standard dimensions and qualified under the requirements of the ASME code.

Both of these applications produced attractive cost savings over manual electrode welding. They strongly indicated that the process could have wide application for pipelining and might be incorporated into a fully automatic girth welding machine.

Equipment Specifications

Development of automatic butt-welding pipeline equipment for crosscountry transmission line use was predicated on a series of specific requirements:

1. It must produce welds of high quality on types of material in use. The welds must exceed the requirement of API-1104 standard.
2. The equipment must fit into the existing methods of operation.
3. It must utilize the standardized pipeline weld joint design so that mill-delivered pipe could be used without regard to whether the joint would be used for a manual weld, a double-joint weld, or automatic weld.
4. It must allow for minor variations in joint fitup and variations in out-of-roundness and bevel preparations.
5. It must be lightweight and portable, yet extremely rugged, and designed for the normal pipeline usage. It should incorporate weather and wind-shielding devices.
6. Automatic control must be incorporated but should not employ electron tubes. Control must be in the hands of the man operating the equipment.
7. Welding power and auxiliary power for control must be available from a generator operated by a power takeoff of a crawler tractor, or a gasoline engine.

Experimental Work—Semiautomatic

Exploratory work indicated that the semiautomatic process would be more flexible and economical than the fully automatic equipment for small-diameter pipe.

Experimental work was directed into two separate areas—refinement of the semiautomatic process for small-diameter pipe and development of the fully automatic equipment for large-diameter pipe. Fully automatic equipment was initially restricted to filler and cap pass work.

It developed that the automatic machine could speed up the total welding operation by doing the work of the firing-line gang, the 16 to 20 people who complete the welds beyond the hot pass. One disadvantage is the time required for moving up and making ready. This becomes more of a disadvantage as the pipe size becomes smaller. The semiautomatic process proved advantageous since makeready time was at a minimum.

Laboratory test welds of the semiautomatic process were made in accordance with the API Standard 1104 using 6-in. 0.280-in.-thickness ASTM-A-53 type. These tests were made to qualify the process and to gain cost information. A compari-

Table 1—Welding-time comparison

(6-in. by 0.280-in.-wall pipe standard groove horizontal fixed position)

	Manual arc	Semi-automatic
Welding time, min.	9.02	8.40
Cleaning time, min.	10.50	0.00
Handling time, min.	2.24	2.10
Total time, min	21.76	10.50
Operator factor, %	41.4	80.0

son with manual arc welding is shown by Table 1.

The qualification test for position welding revealed that penetration was complete with no burned-through areas. The face and root-band specimens exhibited only minor defects. The nick-break specimens exhibited excellent weld metal and the tensile specimen broke some distance away from the weld. The welds greatly exceeded the requirements of API standard 1104. X-ray examination revealed a minimum of porosity. In fact, the X-rays revealed that the test weld was more sound than the weld made with manual-coated electrodes.

Time comparison. The most spectacular result was the time comparison, a saving of 52%. One major saving was a heavier weld bead (thicker layer) than manual-coated electrodes. This resulted in one less bead on the 0.280-in.-wall-thickness pipe. The principal saving was the elimination of slag cleaning from each pass. A third time saving results from a higher operating factor since it is not necessary to change electrodes. Cost savings are also realized since the electrode stub and losses and coating losses are eliminated.

Further benefits over a manual-coated electrode welding process became evident:

1. Variations of root opening and root face were less troublesome. This allows for quicker lineup and less delay between welds.

2. The inside contour of the root bead was flatter, an advantage for carrying liquids as it results in less turbulence and wear.

Fig. 2 shows the internal or inside surface of the stringer bead made with microwire. Fig. 4 shows a micrograph of a cross-section of welds made with both processes.

The work indicated that the semi-automatic CO_2 gas-shielded welding process offered sizable potential savings for pipelining. It remained then to develop a gasoline-engine-driven modified constant-voltage welding power source to power the equipment for field use. A 300-amp., 100% duty-cycle slope controlled constant-voltage direct-current welding generator incorporating a 1-kw., 115-volt power supply driven by a four-cylinder gasoline engine was designed.

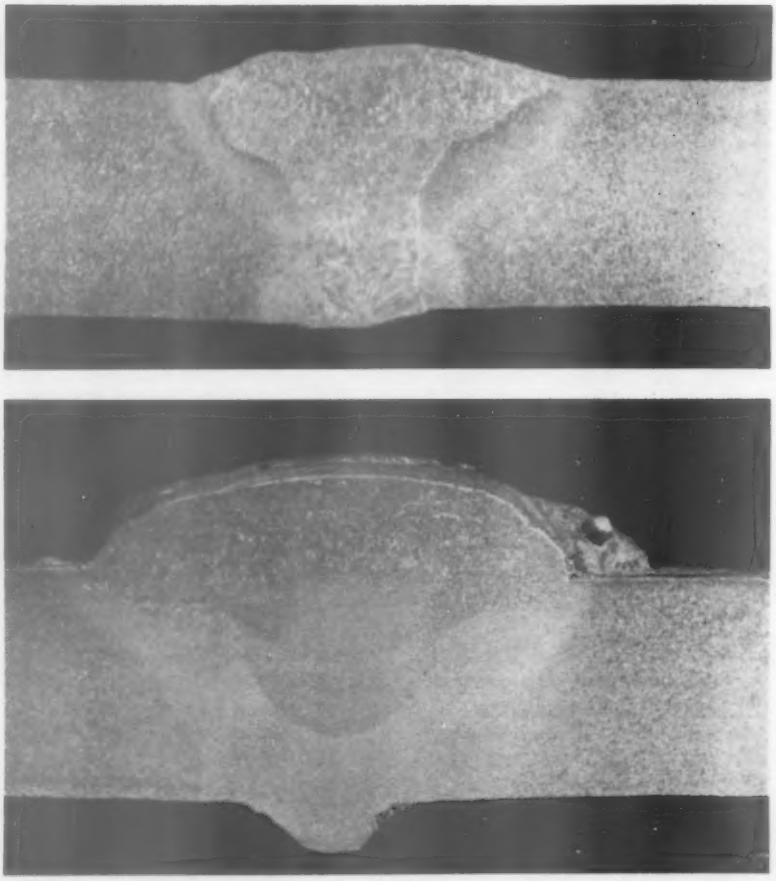
Experimental Work—Automatic

Developing the fully automatic rig involved the mounting of a standard microwire wire feeder and electrode spool on a rotating fixture of the type normally used for flame cutting and beveling pipe. The electrode wire-feed tip was separated from the wire feeder by a flexible-cable assembly and mounted on a positioning device that would allow precise alignment of the wire-feed tip on the welding joint. This positioning device also incorporated a motor-driven head which oscillated the wire-feed tip and gas-discharge nozzle perpendicular to the direction of travel.

A side-delivery type of CO_2 gas-discharge nozzle was employed. The entire wire feeder, wire spool, electrode tip and oscillator, and gas-discharge tube could thus be rotated 180° around the pipe.

Test welds made with this unit revealed additional problems and the need for design refinement. Minor modifications were made on the motor-driven slope-controlled constant-voltage generator and on the welding head. These solved the problems and improved the bead contour of the welds.

The optimum limits of many of the different variables were established. This included the normal conditions such as electrode-wire size and type, the welding current, arc voltage and travel speed, but also the electrode wire stickout beyond the current pickup tip, the size



CROSS-SECTION VIEW of microwire weld (two passes) is shown at top and a similar view of manual coated electrode weld (four passes) below. **Fig. 4.**

HERE THE FINAL PASS is being made with a standard, semiautomatic microwire torch using wire feeder, powered by a newly developed gasoline-engine-driven 300-amp. modified CV welder. Fig. 5.

of the hole in the current pickup tip, the direction and placement of the pickup tip, and the placement of the gas-discharge nozzle, gas flow rate, etc.

Two other important variables were studied: the rate of perpendicular oscillation and the width of oscillation for the various passes. It was found that, for successful outdoor use, a windshield is required around the arc area.

Field simulation. Tests were made outside to simulate field conditions. These were made on a 36-in.-diameter, 0.438-in.-wall-thickness, API Standard 5 LX high-test line pipe. The standard 30° bevel and ⅛-in. root face or nose was employed. The root spacing or gap was ⅛-in. using a pneumatic internal lineup clamp, the type used for field work. Internal lineup clamp rounds up the pipe and holds the root opening to within very close limits. Thus, it was possible to produce a satisfactory stringer bead with the automatic equipment and without the use of a backing ring. The downhill technique was used and the shielding gas was welding-grade carbon dioxide.

The time saving did not appear at first to offer much advantage over the stringer run manually with E-6010 electrodes. It was therefore decided to utilize a manual stringer bead and hot pass with the remainder made by the automatic machine. The weld joint had excellent mechanical properties. Fig. 3 shows the surface appearance of the cover pass produced by the automatic machine.

The time saved using this combination procedure over a welded joint made completely manually was appreciable and warranted the construction of a prototype machine embodying the design requirements found to be necessary.

Design of Prototype

The automatic welder was designed to be as compact and lightweight as possible (Fig. 1). The saddle bracket and rotating fixture are aluminum. Fig. 1 shows the arc shield and the device for oscillating the wire feed tip. Motors and gearboxes are used to rotate the equipment, provide for lateral adjustment and for oscillation of the wire-feed tip in addition to the wire-feed motor itself.

The switchbox on the top of the automatic rig contains the circuitry for wire-feed control, travel speed, adjustment, electrode oscillation, etc. A pendant control, in the hand of the operator, provides for the control of travel speed, welding current, electrode oscillation, electrode inch, alignment, and start and stop.

The box around the arc area shields the arc from the wind. It also carries the viewing windows and a skirt arrangement for contact with the pipe. Because of this arc shield, the equipment can be operated in windy weather. To further provide for inclement-weather operation, a weather shield covers the entire apparatus.

Special generator. The power for welding and for operating the control circuits and motors is provided by a special, slope-controlled, welding generator. This generator is a belt-driven, 500-amp., modified constant-voltage welding generator with a 12-kw. auxiliary power generator which delivers 110/230 a.c. single and three-phase current for operating driving motors. The auxiliary power is also used for light and other equipment on the spread. The generator is mounted on the sideboom crawler tractor and belt driven from a power takeoff.

The generator is mounted on the crawler tractor. A control panel with appropriate motors is also mounted on the tractor. This box allows certain controls to be made by the tractor operator. The sideboom on the tractor will be used to carry the automatic welding rig from joint to joint along the pipeline.

Field Testing Automatic Welder

The prototype automatic welder was successfully used on a section of Pacific Gas & Electric Co.'s 296-mile portion of the Alberta-California Natural Gas Pipe Line. This was the first time in pipeline history that large-diameter pipe was automatically welded in the field. The 36-in. by 0.438-in.-wall type X-52 pipe was welded without rotating it.

The weather during most of the testing period was so bad that the manual-coated electrode welding was discontinued even though the automatic welder continued to operate. This proved the effectiveness of the rain shield and gas coverage shield.

This work involved 0.035-in.-diameter double-deoxidized electrode wire using a welding current of 160 amp. d.c. reverse polarity and low arc voltage. The stringer and hot pass were placed with manual-coated electrodes using E-6010 and E-7010 respectively. Following this, the automatic welding machine made a complete filler pass, a stripper pass from approximately the 2-o'clock position to the 4-o'clock position and from the 10-o'clock position to the 8-o'clock position and then the full cap pass.

All passes were made downhill. The travel speed of the automatic welder was approximately 10 in. per minute. The time from the start of one joint to the start of the next was approximately 45 minutes. Lining up and making ready consumed the major portion of this time. Qualification test bars met the requirements of API Standard 1104.

Test reason. The field testing and production welding covered approximately 30 days. The principal reason for this field test was to gain sufficient experience so that the design of the equipment could be modified and finalized and so that the process and procedures could be refined. It developed that move-up time represented a major portion of the joint-to-joint time.

This was complicated by the fact that the pipe was coated with Somastic. The coating is several inches thick and is to within approximately 9 in. of the weld joint. The coating created an interference when lining up the automatic welder. Plans were made to revise the clamping arrangement to avoid this problem.

All welds made with the automatic equipment were X-ray inspected. The results were acceptable under the standards of acceptability of API Standard 1104. The X-rays showed evidence of porosity or scattered gas pockets in the weld metal. This porosity seemed to come from the weld metal deposited by manual-coated electrodes. The porosity was not in evidence when the gas-shielded process was used for the initial welds. This pointed the need to further refine the procedure to completely eliminate the manual-coated electrode welds.

Modifications and Procedure

After the field testing on the 36-in. pipeline, the equipment underwent another series of yard tests. One major change was to make the initial pass with the semiautomatic equipment rather than manual-coated electrodes. Both quality improvement and a substantial cost savings resulted.

The microwire pass equaled in thickness the stringer and hot pass associated with coated electrode welding. Savings were due to the complete elimination of slag cleaning of the stringer pass and cleaning of the hot pass. The filler, stripper, and cap pass were then made and the X-rays were excellent.

Investigations of the deposited weld metal produced by the automatic welder were made. An independent laboratory reported that the metallurgical quality of the gas-shielded weld metal was superior to that of the weld metal normally produced with manual-coated electrodes. When utilizing the revised procedure or all gas-shielded welded procedure, the requirements of API Standard 1104 were achieved.

In an effort further to improve the speed of the operation, experimental welds were made with 0.045-in.-diameter electrode wire. Procedures using this size wire again improved the welding speed.

Design modifications were made on the welding equipment. This involved making the entire framework lighter, revising the pipe-clamping arrangements, etc.

Semiautomatic Equipment

A 6-in. pipeline under construction in Colorado, for Rocky Mountain Gas Co., was chosen as the job to field test the semiautomatic pipe-welding process. It involved over 100 miles of 6-in. by 0.156-in.wall-thickness standard 5L Grade B electric-resistance-welded line pipe. The location was on the western slopes of the Rocky Mountains, with extremely rugged terrain.

The standard semiautomatic microwire torch and wire feeder, powered by a newly developed gasoline-engine-driven 300-amp. modified CV welder, was used. The stovepipe method was used without double jointing. Each joint was welded in order and without rotating the pipe. Backup rings were not used The standard 30° bevel with the 1/16-in. root base and 1/16-in. root opening were used.

The welding crew consisted of three welders. The head welder, with one helper, lined up the pipe joints with standard lineup clamps. The microwire stringer or root pass was of sufficient thickness that it replaced the normal stringer and hot pass obtained with manual electrode welding procedures. There was no cleaning after the stringer pass.

Two additional crews of two men each then made the second and final pass for each joint. Fig. 5 shows the final pass being made. The gasoline-engine-driven CV welders were carried in a pickup truck which was driven along the pipeline right-of-way. The rear welders alternated joints since there was a larger volume of weld metal required per joint than for the stringer-pass welder. The downhill technique was used for all passes.

Records set. As the welding operators became accustomed to the semiautomatic equipment they set production records. There were 132 joints per mile, and the head welder was producing over 215 joints in an 8-hour day. This amounted to a stringer weld in slightly over 2 minutes, including moving up and lining up.

Actual arc time was approximately 1 minute. The two rear welders were able to more than keep up with the head welder. In addition to the speed of the spread, the manpower required was considerably reduced and extra equipment was not required since fewer passes were involved.

Procedure qualifications and welder qualifications were quickly made on the job and passed the API Standard 1104 requirements without difficulty. Job inspection was speeded up since it was not necessary to clean the final weld pass. The production record and weld quality were so outstanding that the equipment completed the full welding job.

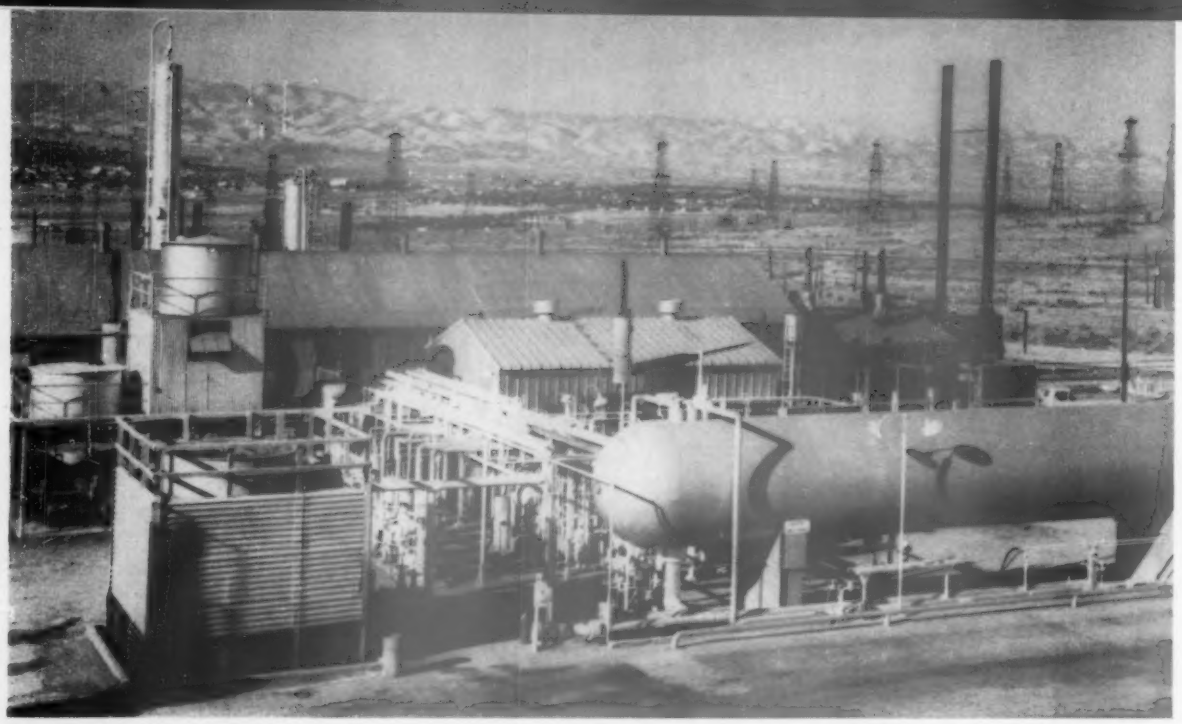
Model PKGC 350
with automatic wire feed

Micro-wire **—Another major welding breakthrough that greatly reduces costs on cross-country pipelines.**

- **Both external and internal line-up clamps may be used**
- **Weld quality meets the requirements of API Standard 1104**
- **Normal stovepipe method of operation is employed**
- **No back-up rings necessary, no weld cleaning required**
- **Avoids electrode changing and stub-end loss**

***See an actual demonstration of this revolutionary Micro-wire* WELDING PROCESS.**

HOBART BROTHERS COMPANY
BOX OJ-121, TROY, OHIO

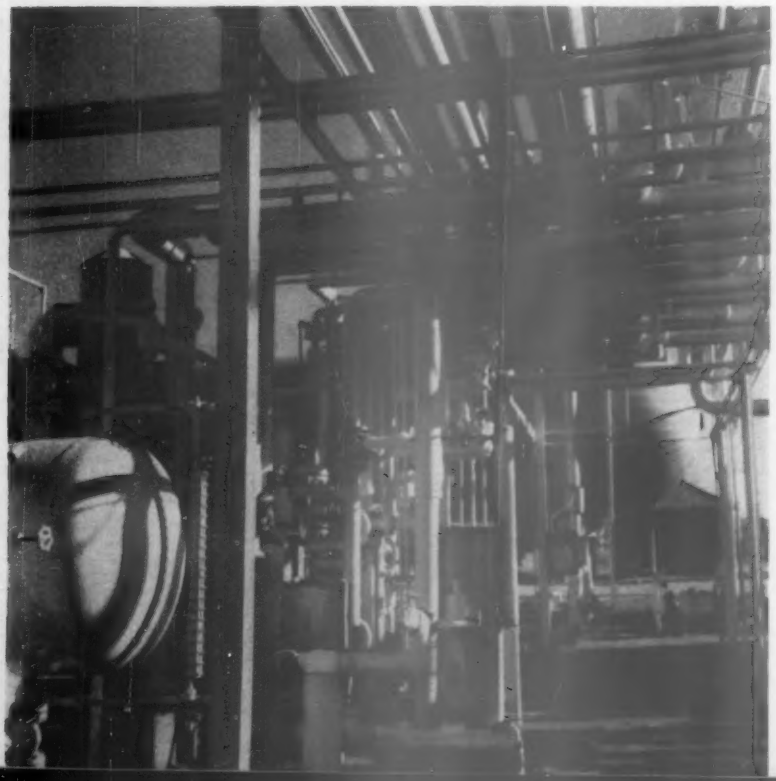


LIQUID CARBON DIOXIDE PLANT, with components of the natural-gasoline plant in the background. Small cooling tower serves the CO_2 plant. Horizontal tank is liquid CO_2 storage unit.

Another waste-product stream is converted into profit by this . . .

Carbon dioxide liquefaction plant

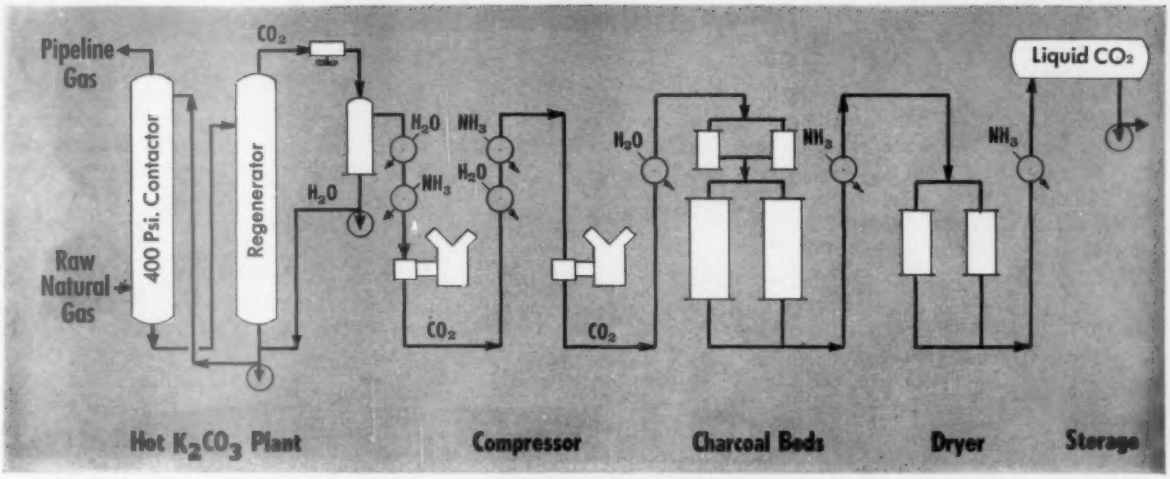
BY JOHN R. McCLANAHAN AND BRENTON O. BUCK



ONE OF THE FIRST commercial plants to extract carbon dioxide CO_2 from natural gas, by the hot-potassium-carbonate process,[1 2 3] was constructed by Honolulu Oil Corp., shortly after basic work was published by the U. S. Bureau of Mines.[4] On completion of the carbonate facilities approximately 20 tons per day of CO_2 were available at the vent line of the carbonate plant regenerator. To market this otherwise waste product, Honolulu built a liquefaction plant to convert this CO_2 into a salable product.

Uses. Carbon dioxide has properties that make it desirable for several commercial uses. It is used extensively in the food industry, the

AMMONIA - REFRIGERATION TANK of liquid CO_2 plant is in left foreground, with CO_2 condenser immediately behind it, and liquid CO_2 storage tank in the background.



NATURAL GAS containing 8% CO_2 is feed stock for the liquid CO_2 plant.

The authors

John R. McClanahan was plant supervisor for Honolulu Oil Corp. when this plant was being built and when it was placed in operation. At present, he is plant foreman in charge of the Cymric joint-venture absorption plant for Tidewater Oil Co. McClanahan formerly held several positions in a long association with Honolulu Oil before that company was sold.

Brenton O. Buck is a partner in Mustang Engineering Co. of La Habra, Calif., and was plant designer for this facility. Prior to his present position, he was with Petrocon Engineering Co. and for a number of years with Cities Service Oil Co. as a plant, process, and project engineer. Buck is a graduate of University of California and has attended other universities for graduate work.

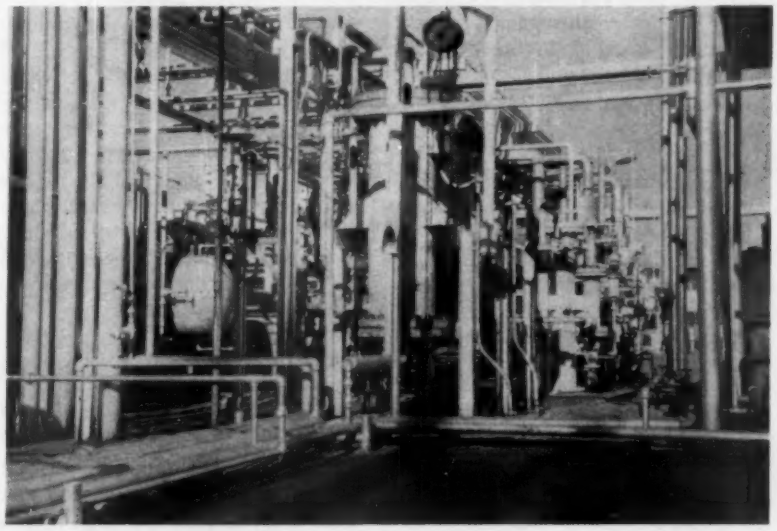
Properties. As a gas, CO_2 is colorless and odorless. As a liquid it is also colorless, having an appearance and density close to that of water. Carbon dioxide may be liquefied at any temperature between its triple point (−70° F.) where it may exist in any or all of its three phases, and its critical point (87.8° F.), above which it is always a gas. Liquefaction is accomplished by compressing the gas to a pressure corresponding to its liquid vapor pressure at the cooling-medium temperature.

Generally, a commercial plant operates close to either one of two sets of conditions. If liquefaction is to be accomplished by compression and simple cooling by water, three or four stages of compression and cooling to just below the critical temperature of 87.8° F. are used. If liquefaction is to be accomplished by compression and refrigeration, two or three stages of compression are used, with refrigeration to about 0° F. being common. The latter system was selected as being the more economical for Honolulu's plant because of the utilities involved and the compression facilities available.

CO_2 removal. Referring to the flow sheet, natural gas containing approximately 8% CO_2 from the gasoline-plant compressors at about 400 psig. is delivered to the hot-potassium-carbonate (K_2CO_3) contac-

beverage industry, the rubber industry, the machine and tool industry, the aircraft and missile industry, the drug industry, as an anesthesia for surgery, for agriculture, and, of course, in fire extinguishers.

Of special interest to the oil industry is the use of CO_2 in secondary-recovery processes. It is particularly well adapted to this use for two reasons. Carbon dioxide added to water forms a weak acid which among other things reduces pH and surface tension allowing a greater volume to be injected. These factors help to maintain a clean well bore in flooding operations. Tests have shown CO_2 reduces the viscosity of the oil and has a greater sweep efficiency than most gases, therefore allowing greater recovery.[6]



PROCESS AREA for liquid CO_2 plant includes ammonia-refrigeration storage tank, charcoal adsorbers, and interstage scrubbers.

tor. There the CO_2 is absorbed into a hot 20% K_2CO_3 solution. This solution then is passed to a regenerator (at a pressure of 2-3 psig.) where a relatively pure CO_2 stream is stripped from the solution. As stripped from the carbonate solution, although 99%-plus pure, the CO_2 does contain trace amounts of contaminants present in the natural gas.

At the outlet of the regenerator, the CO_2 is available at about 140° F. (after air cooling) and near atmospheric pressure, which is the optimum for the stripping operation.

Compression. Selection of the number of stages of compression for this point was governed by two prime considerations: (1) the suction pressure and the liquid storage pressure, or the over-all compression ratio necessary, and (2) the number of compressor throws available on a suitable compressor. Since the horsepower required for the total compression load of carbon dioxide and refrigerants was something less than 200 b.hp., the most simple and economical selection was a compressor with two cylinders for the CO_2 compression and one for the refrigerant.

Prior to compression, the gas is cooled in two steps, first by water to 80° F. and then by ammonia to about 50° F. From these coolers, the gases pass to a suction scrubber which traps off condensed water and any high-boiling contaminates. After the first stage of compression to about 70 psig. the gas is again cooled by water followed by ammonia, scrubbed and compressed through a second stage to about 450 psig.

Purification. On leaving the second stage of compression the CO_2 is cooled with water. After scrubbing, the gas passes through two of four charcoal beds in series. The first bed is a small guard disposable bed to remove any heavy components; the second bed is much larger and is a regenerative type.

The beds are composed of activated charcoal derived from a mixture of coconut and walnut shells. This material is a selective adsorbant for hydrocarbons and other organics in the presence of wet CO_2. The two regenerative beds are operated in parallel in this process on automatic time cycle. At the end of a predetermined time, corresponding to about 10% bed saturation, the beds are switched electropneumatically, the spent bed being regenerated by a combination of steam and internal electric heaters. Plant steam is used, which is first self-superheated (by expansion and heat exchange) and then further superheated in the beds by imbedded electric heaters. When the outlet temperature of the steam reaches 500° to 600° F., the steam flow and the heaters are turned off and the bed is cooled and dried by cold dry gas from the liquid storage tank.

TYPICAL PLANT OPERATING DATA

1st stage suction pressure, psig.	1.5
1st stage discharge pressure, psig.	70
2nd stage discharge pressure, psig.	450
Cooling tower water in, °F	70
Cooling tower water out, °F	58
CO_2 out, 1st stage water cooler, °F	64
CO_2 out, interstage water cooler, °F	90
CO_2 out, 2nd stage water cooler, °F	67
Inlet vol., M.c.f.d.	335
Tank recycle vol., M.c.f.d.	65
Production, tons per day	20
Regenerative charcoal beds	
Steam, lb. per hour	55
CO_2 purge & cooling gas rate, M.c.f.d.	65
Electrodryers	
Regeneration temperature, °F	500
Purge and cooling gas rate, M.c.f.d.	13
Ammonia coolers	
1st stage NH_3 cooler, CO_2 out, °F	50
Interstage NH_3 cooler, CO_2 out, °F	60
2nd stage NH_3 cooler, CO_2 out, °F	55
CO_2 condenser cooler, CO_2 out, °F	17

Dehydration. Gas from the charcoal adsorbers passes to a third ammonia-cooled dehumidifier, where more water is removed; then through a scrubber to dehydrators consisting of two beds in parallel containing Alcoa H-151 activated alumina. These beds further purify the CO_2 as well as removing substantially all of the water. They are also electropneumatically switched, and internally electrically heated on time cycle to 500° to 600° F. Recycle CO_2 gas is used as the stripping and cooling medium.

Condensation. After dehydration the CO_2 passes to a thermosiphon condenser (with ammonia coolant) where condensation takes place at about 400 psig. and 10° to 20° F. At the condenser outlet, liquid CO_2 is level controlled from an accumulator into the storage tank. Since delivery temperature of the liquid is approximately −20° F., pressure on the storage tank is regulated at 230 psig.

The −20° F. temperature is reached by the expansion of the liquid from the condenser accumulator pressure to the storage-tank pressure.

Product specifications. Federal Specification BB-C-101 covers several properties of liquid CO_2 relating to purity, sampling and packaging, and special conditions set up for suppliers to the U. S. Army, Navy, and Air Force. In essence, this specification sets up Grade A (medical) and Grade B (nonmedical) with Grade B being subdivided into three types.

This plant produces a product meeting the requirements of CO_2 for special uses (very low moisture). Specifications for this grade are the most stringent of all, requiring at least 99.5% purity and a water content not exceeding 0.092 mg. of water vapor per liter of gas at 70° F. and 760 mm. mercury. In addition the product shall have no objectionable odor. Some contaminants in concentrations of less than one part per million can produce "odor," and depending upon the use or the individual nose, may or may not be "objectionable."

Such extremely low concentrations are beyond the threshold of detection for most mass spectrometers and for practically all normal analytical methods. Operators and buyers thus must resort to the human nose method of test which is generally arbitrary and difficult to regulate precisely.

The ammonia refrigeration system consists of one stage of compression with water condensation at 160 psig. Ammonia is expanded through the dehumidifiers at near atmospheric pressure to chill the CO_2 before each stage of compression. In the CO_2 condenser, ammonia thermosiphons through the shells of hairpin exchangers at a temperature of −10° to −20° F.

After evaporation at that low temperature it leaves the condenser to be exchanged with liquid ammonia from the ammonia condenser before entering the compressor suction. This serves to lower the storage pressure of the liquid ammonia, conserves heat and compressor horsepower and superheats the ammonia gas to guard against liquid

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LET'S COMPARE THESE FEATURES

	SpaceMaker Controller	Controller "A"	Controller "B"
Two starters in 90" height	Yes	No	No
Drawout construction	Complete	Partial	No
Simultaneously disconnects all six main leads (line and load)	Yes	Line Only	Line Only
Automatic shutters isolate line	Yes	Yes	No
"No-tool" inspection of contacts	Yes	No	No
Track-resistant, flame-retardant insulation	Yes	No	No
Contactor construction	Double Break	Single Break	Single Break
Overload relays visible from outside	Yes	No	No

ALLIS-CHALMERS

A-1521

ideas and news

Control centers simplify maintenance: Allis-Chalmers low-voltage motor control centers have been designed with the maintenance man in mind. TRACK-GUIDE draw-out construction and plug-in terminal blocks simplify inspection—make it easy to remove units. Special bus connectors and heavy bus supports improve reliability.

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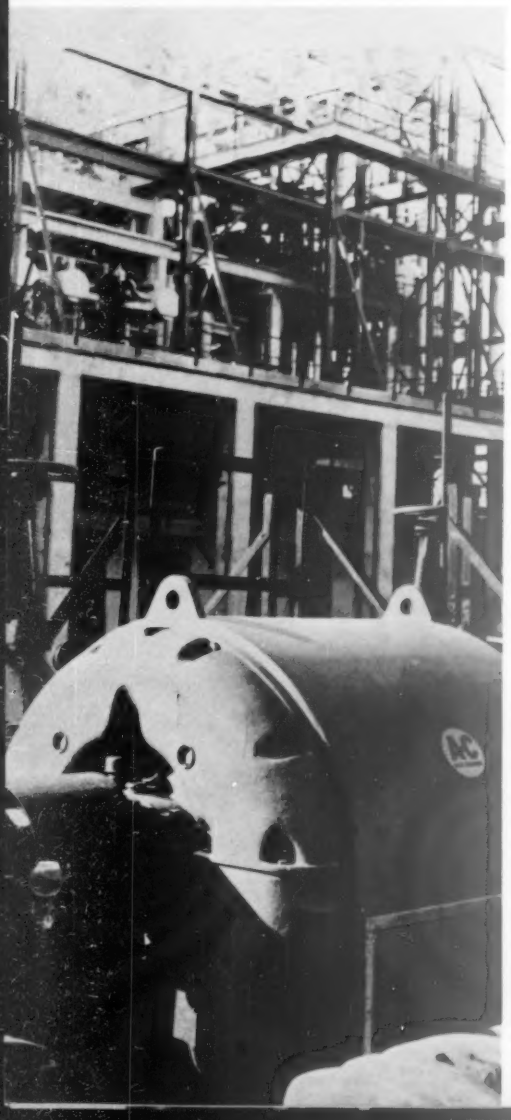

Open motor "weathers" the weather: Sandstorms, snowstorms — even hurricanes — cannot affect the remarkable SILCO-FLEX insulation in SUPER-SEAL motors. This insulation is equally resistant to oil and most corrosive atmospheres. Refineries, pipelines and chemical plants are cutting initial costs and maintenance expenses by installing SUPER-SEAL motors. And, because they are open type, they have a 15% higher service factor than conventional TEFC units. You can get these motors in a hurry, too. Most squirrel-cage ratings between 150 and 3000 hp are available as Standard Pre-Designed motors. This means you get complete specifications immediately–delivery in 45 days or less.

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ALLIS-CHALMERS

being carried into the ammonia compressor cylinder.

Water cooling for the plant is a standard 12 by 12 by 12-ft. induced-draft cooling tower, with asbestos sheathing and redwood internals built over a concrete basin.

Plant CO_2 storage consists of an 80-ton-capacity horizontal tank. This tank is similar to a standard propane storage, except for the insulation and gaging device. It is supported on two piers, with one end being fixed and the other on rollers to provide for expansion and contraction.

Insulation consists of 4-in.-thick polystyrene foam. This is protected by a weathertight covering of aluminum. The filling, loading, and vapor-return lines from the tank are insulated with the same materials except that standard aluminum pipe covering was used as a weather coating.

Since conventional gages would frost from atmospheric water vapor, the tank is provided with an internal float that is magnetically coupled through a diaphragm of nonmagnetic stainless steel to a dial indicator on the outside of the tank. Loading is handled with a conventional propane-loading pump.

Transportation. The liquid product from this plant is sold at the plant site. The hauler uses a tractor and trailer with tanks very similar to propane tanks except insulated in substantially the same manner as the plant storage tank. Custom has dictated that carbon dioxide be sold by weight, so each load leaving the plant is weighed for accounting purposes; however a liquid-displacement meter is installed in the loading line to assist in loading trucks. Maximum load capacities are determined by spew rods.

At an average temperature of 60° F. a cylinder containing liquid carbon dioxide has a pressure of about 735 psig. To maintain a pressure of less than 250 psig. it is necessary to vent a small quantity of the product, even with a well-insulated tank.

Safety controls. All scrubbers and the storage tank are equipped with high-level alarms and high-level shut-down devices connected to the compressor engine. Should the engine be shut down by any cause, a minimum-pressure switch closes all motor valves in the ammonia system to prevent freezing; at the same time activating a relay to shut off the electro-pneumatic systems. A minimum-pressure alarm is installed on the intake line to indicate a vacuum on the regenerator should the back-pressure regulator fail.

The engine is equipped with the customary safety devices and in addition a vibraswitch is installed on the engine to shut it down should any serious malfunction occur. A crankcase level control feeds oil to the engine as needed from a drum located outside the compressor building. A time delay is installed to automatically activate all engine-shutdown devices a predetermined time after startup.

A temperature controller stops or starts the fan on the cooling tower to maintain water temperature within desired limits. A vibraswitch on the fan deck, near the tower's plenum chamber protects against damage by the fan if it should malfunction.

Honolulu's plant currently is capable of producing about 25 tons per day of approximately −70° F. dewpoint liquid carbon dioxide. The increasing demand for liquid CO_2 in industry, agriculture, and particularly oil-water-flood operations will lead to the building of more such plants in the future.

Acknowledgment

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BOOKS

PETROLEUM EXPLORATION HANDBOOK. Edited by Graham B. Moody. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York City 36. 858 pp. $23.50.

Here is a complete summary of petroleum exploration organized into a single, convenient volume. Prepared by a team of specialists, it provides practical information and scores of current, applicable ideas.

Each of the 25 chapters is devoted to a specific phase of exploration—from the inception of an exploratory project, through its implementation, to consummation in a completed well. All exploration activities are described and correlated succintly and clearly.

Here are authoritative discussions of basic concepts; the philosophy of exploration; the organization of exploration personnel; the risks involved in searching for oil; the fundamentals of origin, collection, and entrapment of oil; active field examinations, interpretation of results, and the report; drilling the exploratory well and estimating the reserves discovered; and a description of laboratory procedures with attention to the role of research in exploration.

The practical information includes many recent advances. Scores of illustrations, diagrams, and charts help to make this handbook a fine reference for anyone concerned with oil-exploration activities.

RUSSIAN-ENGLISH CHEMICAL DICTIONARY. By Dr. Eugene A. Carpovich. Published by Technical Dictionaries Co., Box 144, New York 31. 352 pp. $14.

This book belongs to the special dictionary class. It is intended for the English-speaking scientists, researchers, engineers, editors, librarians, translators, students, and other workers who deal with Russian publications in the fields it covers.

Up to date in every respect, the dictionary contains over 29,000 Russian entries and covers the broad range of subjects listed below:

- Inorganic, organic and physical chemistry.
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- Minerals.
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- Pharmacology.
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CHEMICAL ENGINEERING FACULTIES, 11th edition. Published by American Institute of Chemical Engineers, 345 East 47th St., New York 17. Soft cover, 82 mineographed pages, $3.

This publication lists a wide variety of information for over 140 schools in the United States and Canada, such as names and degrees of faculty members, names of placement officers, types of graduate work offered, and degrees granted in 1960-61.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

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PIPE INSPECTORS

BY W. L. NELSON, Technical Editor and Petroleum Consultant

Refinery processing governs cost of construction and operation

THE OIL AND GAS JOURNAL'S Survey of Refineries of March 3, 1961, provides excellent data by which the kinds of refineries in operation in 1960 can be determined, and especially the amount of duplication and sizes of process units now used.

Of the 298 refineries in the U. S. (Table 1), 135 of them may be classifield as small specialty plants. Forty-one are primarily topping plants, 28 conduct only thermal cracking, 44 are primarily asphalt refineries, and 22 produce lubricating oils (26% lubes). In addition, 28 complete large refineries also produce lubricating oils but the average yield of lubes from these plants is only 4.5%. About 60% of the total refining capacity (135 refineries) consists of fuel-type refineries, and of these about one-fourth conduct coking (as well as many of the large complete refineries which were classified as lube refineries).

The very small size of many of the process units (Table 2) is noteworthy. Apparently the economical size of unit is much smaller than the sizes ordinarily economical.

Table 1—Types of U. S. refineries during 1960.

	No. of refineries	Capacity, B/SD	Average refinery, B/SD	Range in size, B/SD	Lubes B/SD
Topping:					
Topping only	30	76,645	2,600	200- 8,000	.....
Top and reform	4	17,300	4,300	1,800- 8,000	.....
Top, reform, and hydrogen treat	7	39,400	5,600	1,700- 7,700	.....
Thermal:					
Thermal (and poly)	10	43,860	4,400	1,000- 10,000	.....
Thermal and coking	1	15,000	15,000	.....	.....
Thermal and reform	12	100,830	8,400	1,500- 19,000	.....
Thermal, reform and hyd. treat	5	42,700	8,500	4,200- 13,200	.....
Asphalt:					
Topping and asphalt	16	78,195	4,900	1,500- 10,000	.....
Top, vacuum and asphalt	20	173,830	8,700	1,800- 40,000	.....
Top, vac., hyd. treat and asphalt	2	19,500	9,750	6,500- 13,000	.....
Thermal and asphalt	2	6,600	3,300	3,000- 3,600	.....
Thermal, hyd. treat and asphalt	4	45,000	11,250	1,000- 26,000	.....
Lube:					
Topping and wax	1	700	700	.....	.....
Penn.—Topping only	2	4,150	2,070	1,800- 2,350	930
Penn.—Thermal and reform	3	10,300	3,400	2,800- 4,500	4,600
Penn.—Thermal, reform and hyd. treat	1	4,500	4,500	.....	1,000
Penn.—Complete	1	10,400	10,400	.....	2,500
Topping only	2	4,105	2,050	2,000- 2,105	300
Top and asphalt	1	7,500	7,500	.....	1,500
Top and vacuum	2	7,580	3,800	1,580- 6,000	1,300
Top, reform and hyd. treat	1	5,800	5,800	.....	1,200
Top, vacuum and asphalt	8	21,535	2,700	1,000- 5,500	9,060
Complete (usually large)	28	3,739,400	130,000	21,000-378,000	163,060
Fuel-type:					
Coking, etc.	30	1,559,900	52,000	.....	.....
Others	105	4,465,090	42,500	.....	.....

Table 2—Process units in 1960 U. S. refineries and their approximate sizes.

	Approx. U. S. 1,000 B/SD capacity	Percentage of crude-oil capacity	Size of process units: Approx. No. of units	Approx. average B/SD	Small B/SD	Large B/SD	Approx. No. of refineries
Crude distillation	10,500	100	578	18,000	1,000	150,000	298
Vacuum distillation	348	3.3	49	7,000	1,000	16,000	38
Vacuum flashing	3,127	29.8	210	15,000	700	90,000	136
Thermal operations:							
Reforming	125	1.2	22	5,700	150	18,000	17
Gas-oil cracking	*678	6.5	111	6,100	400	12,000	*91
Viscosity breaking	*573	5.5	60	9,500	2,000	18,000	*48
Fluid coking	†102	1.0	...	....	....	....	†6
Delayed coking	363	34.6	35	10,400	3,000	16,000	31
Batch coking	17	0.2	...	....	....	....	2
Total coking	(482)	(45.8)	...	....	....	....	(39)
Catalytic cracking:							
Fluid	‡3,518	33.5	176	14,700	3,000	58,000	112
TCC	‡782	7.4	57	9,700	6,000	20,000	37
Houdriflow	‡244	2.3	...	....	....	....	9
Houdry	‡60	0.6	...	....	....	....	3
Cycloversion	5	....	...	....	....	....	1
Total cat. cracking	(4,609)	(43.8)	...	....	....	....	(162)
Catalytic reforming	1,963	18.7	258	7,600	600	45,000	191
Polymerization—thermal	§0.346	....	...	1,000	....	....	3
Polymerization—catalytic	§150	1.4	146	1,030	40	3,000	131
Alkylation—sulfuric	§318	3.0	80	4,000	720	7,000	66
Alkylation—hydrofluoric	§107	1.0	41	2,600	650	5,000	38
Hydrogen treating:							
S.R. Naphtha and solvents	1,406	13.4	133	10,600	700	50,000	113
Distillates and gas oil	567	5.4	55	10,300	500	48,000	45
Cracked Gaso. and Naphtha	78	0.7	13	6,000	600	....	10
Catalytic recycle	1.2	...	...	....	....	....	1
Lubes	37	0.4	...	8,000	....	....	4
Wax	5.4	...	...	2,500	....	....	2
Others	86	0.8	...	....	....	....	7
Asphalt	§449	4.3	139	3,200	150	8,000	130
Lubricating oil	§190	1.8	...	3,800	100	12,000	49

*Reported residual and general cracking was split into gas-oil cracking and viscosity breaking. †Two of the six units each had the large capacity of 42,000 bbl. per stream day. ‡Including recycle. §Product, not feed.

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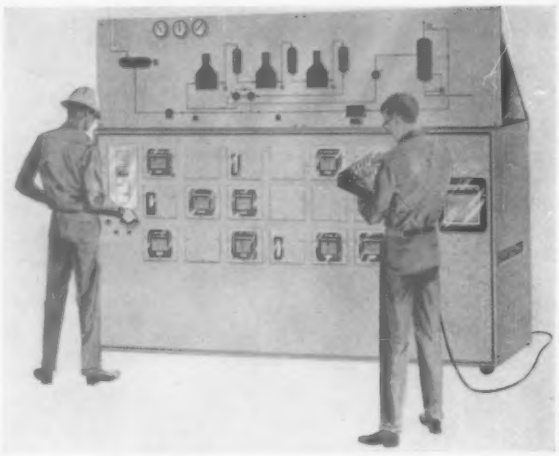


Panels teach process control

CALLED the Carmody Universal Process trainer, this training aid may be visually arranged and programed to represent and actively simulate most process-control systems. Setups, once made, are easily "canned" and may be reproduced any time within a short time. Facsimulations may be made of virtually any commercially practical process.

Even large and complex control rooms are easily simulated by linking several of the trainers together, the maker claims. Previously, facsimiles had to be custom-built to match the control system of each individual installation or type of process. Basically the trainer consists of two panels. The lower one contains 22 stations for plug-in, electrically operated and controlled simulated instruments; six visual and audio alarm stations, and various control switches.

The upper panel has a light-green, magnetic-ceramic surface for grease penciling in flow diagrams, for attaching magnetized symbols, or for displaying small trainers containing component details. The trainer weighs 350 lb. and can be folded into an 8 by 4½-ft. package 16 in. deep. Source: **Carmody Corp.,** 2361 Wehrle Dr., Buffalo 21, N. Y.

Electromagnetic flow meter

This electromagnetic flow meter measures a wide variety of fluids and inconsistent slurries. The meter is said to handle any liquid, including viscous, with no more pressure loss than that of an equivalent length of pipe. Neither laminar nor turbulent flow of process liquids affects accuracy, which is 0.5% of full-scale calibration.

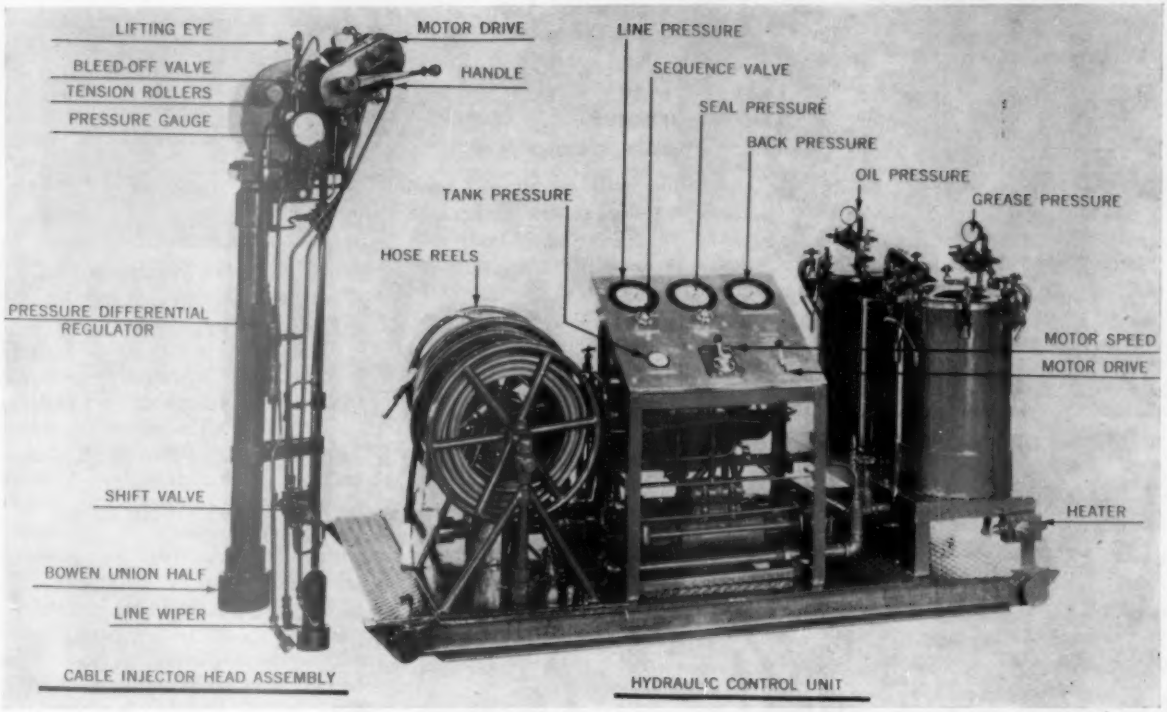
Featuring the electromagnetic flow-measurement technique, the meter responds to fluid velocity, only, providing true volumetric reading.

A 3-step range adjustment is offered: 10, 50, and 100 g.p.m. full scale. Continuous range adjustment is optional. The Model 346 transmitter operates at temperatures to 150° F ambient and handles liquids at pressures to 240 psi. at 200° F. Source: **Hays Corp.,** 742 E. Eighth St., Michigan City, Ind.

New sensor and control unit

The FS/1 sensor and the S-1A control unit, recently developed, promise to be an economical, accurate, and reliable flow-no-flow reporting device, without mechanical impellers or vanes. Applications include pump-off control, recording, telemetering, monitoring flow, warn of freezeups, and automation. The sensor has no moving parts, will withstand pressures to 3,000 psi., is sensitive enough to detect a flow of 2 gal. per hour, and can be easily installed in a conventional tee or welded boss, the maker reports.

The electric signal from the sensor is transmitted into the control unit where it is amplified and, through a transistorized circuit, energizes a relay capable of switching loads up to 5 amps. Input of 110-120 volts a.c. draws less than ½ amp. The reporting device is available for rack mounting, multiple installations, or in explosionproof boxes. Source: **Flotec Corp.,** Box 4246, Santa Barbara, Calif.

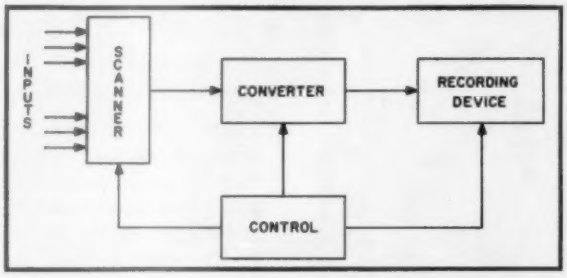


Injector forces conductor cable into wells

THIS CABLE INJECTOR is designed to inject 3/16-in.-diameter concentric cable into wells under pressures in excess of 2,000 psi. It is said to lessen the danger of blowouts, reduce time required to perform wire-line services, and eliminate possible damage to the well reservoir since it isn't necessary to kill the well for these services.

Because of its construction, the cable injector does away with the need for excessively tall lubricators. Since additional tool weight is not required to overcome friction of the seal, the lubricator can be maintained at a more reasonable height. The injector consists of a cable-injector head and a control unit, used in operation in conjunction with a hydraulic power source and a wire-line-hoist unit.

The cable-injector head is of a circular, hollow-center, snail-like configuration, containing the rotating drum. Within the drum are two wraps of cable, rotating within a pressure-contained torus ring assembly. Source: **Bowen Itco, Inc.,** 2429 Crockett, Houston, Tex.



Latest data-logging system

This automatic digital data-logging system is designed to give fast, accurate logging of data for permanent records and computer analysis from test stands, flow processes, and special test setups. The system automatically scans and permanently records data from a large number of points, thereby eliminating manual data recording. The system can monitor continuous processes, permitting detailed analysis of such factors as cost, efficiency, and uniformity.

An electro-mechanical scanner operating at 10 points-per-second is available when data to be logged is generated at slow rates. For high-speed scanning, an electronic scanner is available which operates at rates up to 1,000 points-per-second or more. Source: **Control Equipment Corp.,** 19 Kearney Rd., Needham Heights 94, Mass.

●

Tiny underwater TV camera

Designed for operation to depths of 1 mile, special models are available for operation to depths of more than 7 miles. The transistorized television camera, measuring only 17

by 3⅛-in. o.d. and weighing 8 lb., promises to be useful for well casing.

A portable, transistorized monitor, containing an 8-in. kinescope, camera controls, and a built-in power supply, is available for use with the camera. The entire monitor unit, including rechargeable batteries, fits into a carrying case 16 by 14 by 9 in. Thus, the entire TV system, including several hundred feet of cable, can be carried in the equivalent of two overnight suitcases. The camera and monitor can also be operated from 110 volts a.c. or from 24 volts d.c. power. Source: **Oceanographic Engineering Corp.,** 4930 Naples Pl., San Diego 10, Calif.

•

Wrap-around pipe-repair clamp

Featuring bolts on one side and a thick, butt-seal rubber gasket, the Dresser 360 All-Around Clamp provides a ⅜-in. adjustment on diameter so that a single clamp will fit a number of pipe diameters. Designed for the repair of holes, circumferential breaks, or splits, the clamp can be used on both the

rough barrel or machined ends of asbestos-cement pipe, and on the run of cast-iron and steel pipe.

In addition, it may be used where pipe ends are deflected up to 4° or offset ⅛ in. A sectional lug and the gasket design allow use of the clamp to join pipes of up to ¼-in. difference in outside diameter. A thick spanner plate supports the gasket so that pipes may be connected with as much as 1-in. gap between pipe ends.

The clamp is available in nominal sizes from 2 to 12 in., fitting pipes with outside diameters from 2.38 to 14.5 in. Clamp widths vary from 6 to 30 in. Source: **Dresser Mfg. Div., Dresser Industries, Inc.,** 313 Fisher Ave., Bradford, Pa.

•

Valve reduces gage connections

The number of connections usually required for a gage connection may be reduced with an instrument plug valve now available. The valve and gage installation involves connecting only a ¾-in. male adapter which comes factory installed.

The valve comes in three sizes: ¼, ⅜, and ½ in. It provides gage cut-off, gage bleed, and calibration. Made in an ASA 300-lb. rating, the valve is recommended by the manufacturer for on-off use on rated pressures within temperatures from −50° to 400° F. with gas or liquid, either corrosive or noncorrosive. Source: **Continental Mfg. Co.,** 230 Park Ave., New York 17, N. Y.

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TRADE LITERATURE

Theory and practice of solid lubrication

Titled "Breaking Lubrication Barriers," this new literature piece discusses such barriers to effective lubrication as galling and seizing, extreme pressures, high friction, chemical reaction, temperature and extreme environments, and describes how solid lubricants can overcome them. Bulletin 132 details properties of molybdenum disulfide as a dry-film lubricant, including chemical stability, electrical and magnetic properties, thermal stability, and coefficients of friction. Source: **Alpha-Molykote Corp.,** 65 Harvard Ave., Stamford, Conn.

Gas-regulating-equipment bulletins

These two publications describe a series of vents manufactured as companions to regulators, along with a safety test plate. The vents, featuring large screen areas for unrestricted relief flow, are available in ¼ to 2-in. sizes. They include diaphragm breather vents and relief vents. The test plate may be used to prevent damaged regulators, shorten installation time, simplify hydrostatic testing, reduce regulator inventory, and eliminate line repiping, the literature states. Source: **Reynolds Gas Regulator Co.,** Anderson, Ind.

Hydraulic drill-collar

Operation, assembly, and disassembly of the Fluidrill hydraulic drill collar are described in a new manual, available to interested persons. The publication contains sample computations and charts for picking the correct nozzle size to obtain desired weight on the bit and to make sure that enough horsepower is available for the operation. Source: **Grant Oil Tool Co.,** 2042 E. Vernon Ave., Los Angeles 58, Calif.

Valves for pipeline service

Carbon-steel Hypresphere valves with molybdenum-disulfide-coated spherical plugs are described in a new 24-page bulletin. The literature piece illustrates and gives dimensions for valves ranging from 10 to 26 in. in size and for working pressures up to 1,440 psi. w.o.g. Included is information on valve actuators, electric and pneumatic power controls, welded attachments, and operating extensions. Additional sections describe automatic spheroid launching and receiving and typical Hypresphere installations. Source: **Meter & Valve Div., Rockwell Mfg. Co.,** 400 N. Lexington Ave., Pittsburgh 8, Pa.

Emulsion treating, testing equipment

Fifteen individual product bulletins feature emulsion treating and testing equipment used basically to break oil-water emulsions and separate water and gas from oil. Equipment includes oil-emulsion treaters and testers, gas separators, free-water knockouts, and water filters. Each bulletin offers a description of the product, specifications and dimensions of various sizes, and a cutaway view showing interworking of the equipment. Source: **Continental-Emsco Co.,** Box 359, Dallas 21, Tex.

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FOURTH GENERATION OF BOVAIRDS is being added in portrait form to the walls at Bovaird Supply Co., Tulsa, following the elections of William J. Bovaird as president and Davis D. Bovaird as chairman of the board. Davis (left) is shown placing the picture of William (standing at right) among the Bovairds of the other three generations. Family pictures (top row, from left) are of Walter, William, and Joseph, three sons of the founder, David Bovaird. In the next row, from left, are Merve, Davis, and Frank, sons of William.

Bovaird Supply elects president, chairman

AT BOVAIRD'S ANNUAL stockholders' and directors' meeting in Tulsa, December 5, William J. Bovaird was elected president, succeeding Davis D. Bovaird who becomes chairman of the board. The new president, previously vice president in charge of sales, represents the fourth generation of Bovairds and is the fifth president of this supply company which was started in 1871 in Pennsylvania.

Fenelon Boesche, of the legal firm of Williams, Boesche & McDermott, was elected as a director succeeding the late Bradford J. Williams. Directors reelected were: Davis D. Bovaird, William J. Bovaird, Raymond E. Batchelor, T. H. Trower, R. M. McMahan, and A. E. Booth, of Bradford, Pa. Officers reelected were: Batchelor and Roscoe Ayers, vice presidents; Trower, secretary-treasurer; and M. B. Park, assistant secretary-treasurer.

William Bovaird began working with the company in 1948 at the Russell, Kans., store. He served in Odessa and Midland before transferring to the Tulsa office as assistant to the general manager of stores. He later became general manager of stores and, in 1958, sales manager. His promotion to vice president of sales came 2 years ago.

Davis Bovaird began with the firm in 1920 as field salesman operating out of Independence, Kans. He moved to Tulsa 7 years later as credit manager and treasurer. After being promoted to vice president, he became company president upon the death of his brother, Merve, in 1949.

David Bovaird, the founder, began his services to the industry in the early boom towns of Pennsylvania 90 years ago. The enterprise he started now serves the industry in nine states with 20 stores and seven offices.

PESA elects two new directors

Kenneth H. Swart and W. A. Wolff have been elected to the board of directors of the Petroleum Equipment Suppliers Association, it was announced by H. R. Safford, Jr., PESA's executive vice president. The election took place at the association's annual mid-year meeting of the board held recently in Chicago.

Swart is president of Smith Tool Co., of Compton, Calif. Wolff serves as president of Oil Center Tool Co., which makes headquarters in Houston. Both men have been active in PESA for several years.

E. Palmer Shelton to retire from Chicago Bridge & Iron

Shelton, vice president and regional sales manager, will leave the company December 31 after nearly 40 years of service. Headquartered at Tulsa, he is in charge of CB&I's southern sales region, which covers district sales offices at Tulsa, Birmingham, Houston, New Orleans, and Atlanta.

Shelton joined the steel-plate fabricating and construction firm in 1922 as a design engineer in Chicago. He was assigned to the Chicago sales district in 1923. Shelton was named manager of the Detroit sales district in 1927 and moved to Tulsa as district manager in 1942. He was elected a company vice president and appointed manager of the southern sales region in 1959.

Globe appoints Clarence Strait

Lee Wardle, sales manager of Globe Oil Tools Co., announces the appointment of Clarence Strait as regional manager for Texas, Oklahoma, and export. Strait, who recently was superintendent to Steen Drilling Co., has had many years experience in rock-bits sales and service.

Joe R. Jillson named vice prexy of Rogers & Smith Advertising

J. R. Jillson

The announcement was made by Randell E. Brooks, executive vice president of the Dallas agency. Jillson joined Rogers & Smith in April 1960 as account executive to serve the advertising efforts of Otis Engineering Corp. Since that time he assumed responsi-

bility for several of the agency's other accounts.

Before going to Dallas in 1958, Jillson made his home in Tulsa where his experience included several years as account executive for a Tulsa advertising agency, working with Unit Rig & Equipment Co., Orbit Valve Co., Fred E. Cooper, Seismograph Service Corp., Texas Natural Gasoline Corp., Dresser Engineering, and Sunray-Mid-Continent Oil Corp. Before that he was assistant to the advertising manager of Dowell Division of Dow Chemical for 3 years.

Wheatland Tube begins 3-year, $4 million expansion program

Wheatland Tube Co., with plants at Wheatland, Pa. and Delair, N. J., has announced a $4 million, 3-year program of expansion and modernization of its plant and production facilities at Wheatland, Pa. The company, which manufactures steel pipe, tubing, and electrical conduit, has general offices in Philadelphia.

The first phase of the program will be the building of a 55,875-sq. ft. addition which will accommodate a 15,000-ton storage and shipping area. Included will be a new 2,000-ft.-long railroad siding and truck docks with high-speed cranes to speed deliveries to customers by rail and trucks.

The second phase and major modernization to be completed in late 1962 will be the installation of an Aetna-Standard high-speed continuous-weld mill, which will increase plant capacity to 180,000 tons of pipe a year.

Three elected to key positions by Minneapolis-Honeywell

P. B. Wishart

Paul B. Wishart, president of Minneapolis-Honeywell Regulator Co. since 1953, has been elected chairman of the board and chief executive officer, succeeding Harold W. Sweatt, who has been named chairman of the finance committee. James H. Binger, 45-year-old vice president and director, was elected to succeed Wishart as president. At the same time, the company's directors created a third executive vice presidency and elected Stephen F. Keating, 42, also a vice president and member of the board, to the new post.

J. H. Binger

S. F. Keating

As board chairman, Wishart succeeds the man he also succeeded as president. Harold Sweatt, son of the company's founder, was president from 1934 until 1953. Now 70, he has been a member of Honeywell's top management longer than any other individual. Binger becomes the fifth man to hold the presidency of Honeywell in its 76-year history.

An executive of the company for 15 years, he has had experience in sales, factory production, engineering, and corporate management. Keating has been with Honeywell since 1948, a corporate vice president since 1956, and a director since 1960.

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2
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JONES
SUCKER RODS

Rockwell announces new sales posts in Meter & Valve Divisions

R. R. Bush

Roy R. Bush, now vice president of sales for the Meter & Valve Divisions, previously was vice president of sales west of the Mississippi. Thomas O. Carson, who was formerly assistant vice president of eastern sales, now becomes assistant vice president of sales.

Edward W. Wenrich will be administrative assistant to the vice president of sales. He was formerly headquarters office manager. P. C. Kreuch, vice president, will handle a special engineering and sales assignment in addition to having direct charge of valve actuator and new product sales.

Donald N. Chamberlain named exec. v.p. of Pipe Linings, Inc.

D. N. Chamberlain

Chamberlain succeeds the now retired Robert C. Sargent, who for 10 years served as chief executive officer of Pipe Linings, Inc., Wilmington, Calif., a subsidiary of American Pipe & Construction Co. Chamberlain joined American Pipe & Construction in 1960 and became a vice president of Pipe Linings, Inc. earlier this year.

Dowell makes changes in Dallas

N. D. Krey and M. W. Osborne, general sales engineers at the Dallas office of Dowell Division of Dow Chemical Co., have been advanced to district sales engineers, according to R. S. Ousterhout, assistant general sales manager. Krey will be located in the district office at Midland, Tex., and Osborne at Amarillo, Tex.

Ousterhout also announced that the two vacancies would be filled by C. R. Olson and Ralph Krottinger. For the past 2 years, Olson has been general sales coordinator in Calgary, Alta. Krottinger has been a sales engineer for Johnston Testers, Inc.

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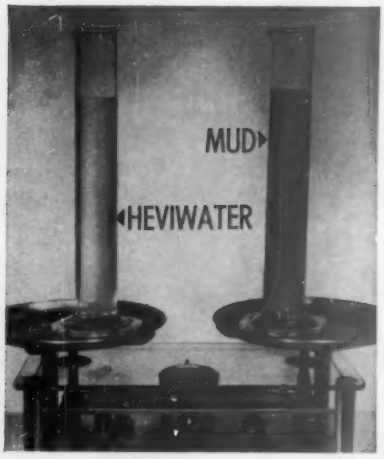
HEVIWATER completion fluid avoids use of mud



Since inhibited Heviwater* is free of solids, it helps operators avoid problems such as pay contamination and the sticking of packers due to the settling out of solids.

Heviwater can be furnished pre-mixed or it can be mixed at the well site using rig equipment. Dowell supervision for mixing is available upon request at no cost.

This table shows the materials which can be used, in addition to fresh water and corrosion inhibitors, to provide various fluid weights of Heviwater:

FLUID WEIGHT (LBS/GAL)	MATERIALS USED
8.33-10.0	NaCl
8.33-11.0	NaCl + $CaCl_2$
8.33-11.8	$CaCl_2$
11.8 -14.0	$CaCl_2$ + $ZnCl_2$

Heviwater can be made available wherever this type of completion fluid is needed. Ask your Dowell representative for full information.

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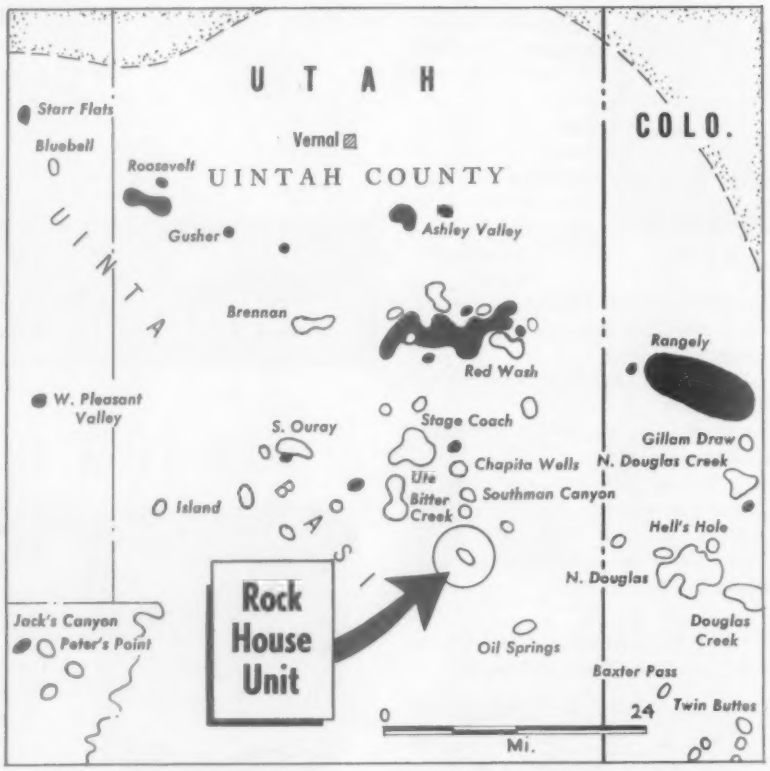
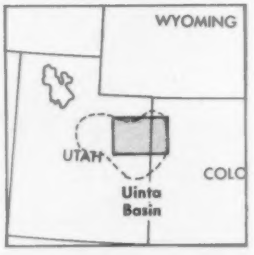


DATA ON ACTIVE FIELDS

Uintah County, Utah Rock House unit,



1. APPROVED field name: Rock House Unit. Location: center of Uinta basin in Northeast Utah.

2. Discovery well: Shamrock Oil and Gas Corp. 1 Rock House Unit, SE SE 10-11s-23e, Uintah County, Utah. IPF (Wasatch) 12.7 M.M.c.f.d. and (Mesaverde) 0.9 M.M.c.f.d., dual producer, completed October 26, 1960.

3. Trend of development: north to south.

4. Number of producing wells: 6.

5. Spacing pattern: 640 acres.

6. Proved acreage: 3,320.

7. Principal operators in area: Shamrock Oil and Gas Corp.

8. Present allowable: pipeline nomination based on reserves.

9. Number of active drilling rigs: 2.

10. Casing program: 13⅜ - in. surface set at 215 ft. with 300 sacks cement. 7-in. oil string set at 5,450 ft. with 310 sacks cement.

11. Average drilling time per well: 38 days.

12. Types of drilling fluid: water-base mud, invert emulsions, gel with 10% diesel, and low-solids mud.

13. Completion methods: perforate casing, acidizing, and fracture treatment.

14. Types and sizes of bits: 51 rock bits; five 11-in. and forty-six 8¾-in.

15. Special drilling problems: Water flows and lost-circulation zones in Green River formation.

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Geology

16. Producing formation: discovery well was dual completion from Wasatch at 4,144-5,008 ft. and Mesaverde at 5,362-82 ft.

17. Reservoir characteristics: not reported for this gas reservoir.

18. Geologic markers: (discovery well) top Wasatch 3,185 ft., top Mesaverde 5,050 ft., Castlegate 7,201 ft., and Mancos 7,280 ft.

19. Type trap: stratigraphic with lenticular sands.

20. Core data: no cores have been taken.

21. Estimated recovery: 10 billion cubic feet of gas from each 640 acres.

22. Pressures: Wasatch—SIP 1,785 psi. and BHSIP 2,074 psi. Mesaverde—SIP 2,276 psi. (tubing).

23. Tests and logging procedures: drill-stem tests, I-Es, Laterolog, sonic, and gamma ray.

24. Pipeline outlets: El Paso Natural Gas Co., Mountain Fuel Supply Co.

25. Exploration methods before discovery: surface and subsurface geology.

26. Average costs: dry hole, $65,000; flowing well, $130,000; average total depth, 6,500 ft.; footage rate, $6.00.

A review of the activity in the Uintah basin so far this year shows that at least eight new producing-area wildcat wells were successful. The new fields in order of discovery were: Island Unit, Uintah County; Cisco Area, Northeast, Grand County; Stagecoach Unit, Uintah County; Book Cliffs Unit, Grand County; Island Unit, East, Uintah County; Fence Canyon Unit, Uintah County; Uintah Area, SE, Uintah County; and Stagecoach Unit NE, Uintah County.

All were single-zone wells except Fence Canyon Unit which was dually completed as a gas well from the Morrison at 8,378-8,520 ft. and the Buckhorn from 8,236-83 ft. The Morrison flowed 0.6 million cubic feet and the Buckhorn flowed 1.2 million feet daily.

Island Unit and Island Unit East made gas from the Wasatch as did Stagecoach Unit NE, Stagecoach Unit, and Uintah Area. Book Cliffs Unit discovery flowed gas from the Dakota while Cisco Area NE flowed oil from the Bushy Basin formation from 1,579-96 ft.

NEW PRODUCT LITERATURE

Motorola has introduced a new line of "Handie-Talkie" portable two-way radiophones with fully transistorized receivers that double battery life and cut operating costs in half.

The new radiophones can be operated for as little as nine cents an hour on normal duty cycles. Extra duty dry battery packs last 10 or 12 days compared to five previously. Lightweight packs last five days compared to two before. Each unit is interchangeable with any of the power packs available from Motorola.

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Versatile Halliburton Tools Test Four Zones On Single Round Trip

Covington County, Mississippi—Four separate zones from 14,240′ to 13,126′ were individually tested by Halliburton on a single round trip. Keying the success of the operation was a testing string including Halliburton's versatile Retrievable Test-Treat-Squeeze (RTTS) Packer, Retrievable Cup-Type Bridge Plug, and Retrievable Valve Tester (RVT). Here's how the system worked:

1. Drillable, permanent-type bridge plug set at 14,402′ to isolate sections below.
2. Testing string run with RVT in running case above RTTS Packer and Retrievable Cup-Type Bridge Plug below it.
3. At 14,348′, Retrievable Bridge Plug was set, RTTS Packer freed from Bridge Plug and set at 14,213′ to test through existing perforations.
4. RVT tool operated to record flowing and closed-in pressures, then retrieved on wire line.
5. Test recovery reversed from string, RTTS Packer unseated and re-latched to Retrievable Bridge Plug.
6. String moved up; perforations made with wire line tools run through the full-opening RTTS Packer, and testing operation repeated at three other shallower zones.

The operator was well pleased both with the reliable results as well as the sizable savings. Since the Retrievable Cup-Type Bridge Plug and RTTS Packer combination can straddle any interval, regardless of thickness, compared with other methods, this tool system saved at least three round trips and several subsequent bridge plug drill-outs.

New Halliburton Tools Record Pressure Changes In Slim Holes

Hardin County, Texas — All of the desired formation pressure changes were recorded in a test performed in 3½″ liner on a perforated interval from 9,200′ to 9,216′. At this depth, the casing contained 16.5 lb. per gal. mud and had a temperature of 175°F.

Halliburton testing assembly included a 1¾″ O.D. Hydro-Spring Tester with 1¾″ O.D. Locked Open By-Pass, 1¾″ O.D. Circulating Valve, B.T. (Bourdon Tube) Pressure Recording Device in 1¾″ running case, 1-11/16″ jars and a 2-11/16″ O.D. RTTS Packer.

The packer was set and the Hydro-Spring Tester opened at the desired interval. The well flowed pipe line oil after one hour. Upon completion of the test, reverse circulation cleared the recovery from the well and the testing equipment was removed.

Single Round Trip Acidizes 12 Zones With Halliburton Special Tool Team

Gaines County, Texas — Twelve different zones were isolated and treated in 16½ hours during a single trip with a 4½″ Retrievable Cup-Type Bridge Plug and RTTS Packer on the drill string. Performing this feat called for running the Retrievable Bridge Plug below the RTTS Packer to 6,960′. Then the plug was set and the RTTS Packer was easily disengaged, pulled to 6,924′, and set. This zone was acidized with 500 gallons of acid. The pressure was bled off, the RTTS Packer was unseated and lowered to engage and unseat the retrievable plug. This operation was repeated successfully treating twelve different zones.

For reliable testing results... call your experienced Halliburton tester.

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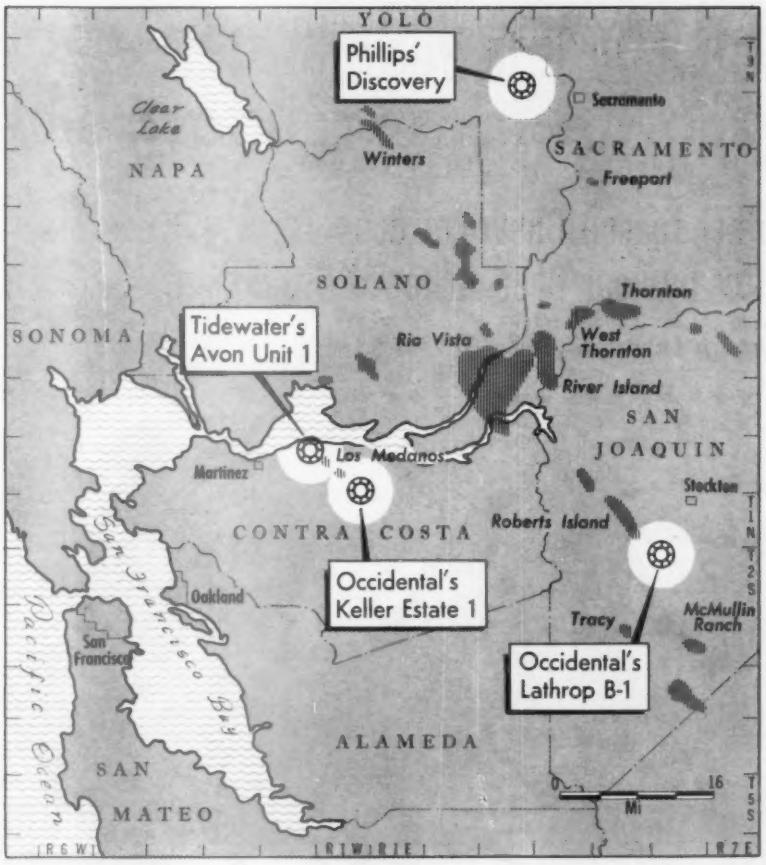

NORTHERN CALIFORNIA wildcat campaigns have been rewarded at all these spots in the past 3 weeks. The score: two new fields, a major confirmation, and a prolific field well.

California search goes on

BY CARL LAWRENCE
West Coast Editor

GAS EXPLORERS in California racked up an impressive score recently—two discoveries, confirmation of what may become a major gas discovery, and completion of another prolific gas well.

Biggest news comes from Lathrop field in San Joaquin County where Occidental Petroleum Corp. is preparing to complete its 1 Lathrop unit B, which looks like one of California's best gas wells.

The B-1 tested 22,653 M.c.f.d. on a series of drill-stem tests of four pay zones in the Upper Cretaceous E formation. This ranks as one of the best formation tests in the state's gas play. McCulloch Oil Corp.'s 1 Duarte in Los Medanos field tested 29 M.M.c.f.d. early this year and generally is considered the biggest test in recent years.

Net sand count on the B-1 has been set at 780 ft. based on IES, Microlog, and Sonic log. This is 104 ft. more than the 676 ft. of sand showing on the mud log (OGJ, Nov. 20, p. 146).

However, not all the gas sand can be produced. The well went to a total depth of 8,936 ft., but surface pipe was only 9⅝ in. and casing 5½ in. Hole diameter will limit the completion to one of the deep sands, probably at 8,353-85 ft. where the well tested 8,525 M.c.f.d.

A deeper test has been started in Lathrop on a 642-acre unit formed by Occidental and Universal Consolidated Oil Co. Location is in 4-1s-6e, ½ mile northeast of the Lathrop discovery well and 1¼ miles east of the B-1 in 5-1s-6e.

The Occidental - Universal Consolidated unit 1 will go to at least 10,000 ft. in an effort to cut through the E zone, which normally is not found in this area of the San Joaquin Valley. The B-1 was still in the gas-sand series at 8,936 ft., but lost circulation forced bottoming the hole. The F zone, which is the prime producing zone in the state's gas play, may be reached in the Occidental-Universal Consolidated well.

The B-1 is 4,000 ft. west of the discovery, Lathrop unit A-1. The discovery was completed flowing 16,119 M.c.f.d.

G. A. Kadane & Sons are drilling below 6,000 ft. about 1½ miles northwest of the B-1. The Kadane well, 2 Roberts Island unit, is in 6-1s-6e. Great Basins Petroleum Corp. is expected to get in the play soon since it holds acreage offsetting Occidental to the south.

Two discoveries. Occidental owns one of the two apparent gas discoveries.

The company is preparing to complete the 1 Keller estate in 35-2n-1w in Contra Costa County after logging a gas sand in the Domengine formation at 1,641-44 ft. and 1,735-70 ft. No tests were run, but the wildcat had a gas kick while drilling through the Domengine.

Phillips Petroleum Co., in its first try at finding gas in the Sacramento Valley, has come up with an apparent gas discovery in its 1 Swanston in 26-9n-3e in Yolo County.

Phillips took the wildcat to 11,194 ft., but came up the hole to 2,160-67 ft. to test the Tehama sand. The well flowed at the rate of 1,392 M.c.f.d. through a ⅜-in. choke during a 1-hour, 20-minute test. The well has 250 ft. of net gas sand in one series, but only the top of the sand was tested.

Avon well. Tidewater Oil Co. has completed a fault-block discovery a mile from its Avon refinery with a flow estimated at 5,250 M.c.f.d.

The test, Avon unit 1 in 12-2n-2w in Contra Costa County, was scheduled to go to 8,000 ft. to test the Upper Cretaceous, but was bottomed at 6,524 ft. The well is about a mile northwest of Los Medanos field and produces from the Domengine sand found in Los Medanos.

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Piceance may become biggest gas producer in the Rockies

BY CLARK MILLISON
Consulting Geologist
Englewood, Colo.

PICEANCE BASIN of western Colorado, located in Garfield, Mesa, and Rio Blanco counties, is surely destined to become one of the largest gas-producing areas in the Rocky Mountains. It has been known to contain gas accumulations for 70 years, but development has been retarded by rugged terrain (altitudes range from 5,000 to 10,000 ft.) and long distances from refineries and pipelines.

Since 1956, however, with the completion of the Pacific Northwest Pipeline (now El Paso) along the west side of the basin, development has accelerated.

Many scattered but unexploited gas discoveries in at least 10 different horizons ranging from 2,000 to 10,000 ft. in depth have proved large areas for development of prolific potential gas fields. More pipeline outlets, a fair price for the gas, and the realization that this large potential exists will finally establish the position of this basin in the gas industry.

Gas was first discovered in Piceance in 1890, when a shallow well was drilled to about 500 ft. in Tertiary rocks on the White River dome in north central Rio Blanco County. The first important gas discovery was Piceance Creek field in 1930 in the center of Rio Blanco County. This field now has 15 gas wells which have produced about 23 billion cubic feet of gas to July 1, 1961, from the Douglas Creek sandstone in the basal Green River formation of Eocene age.

Since 1956, development in the three Colorado counties has accelerated as in Table 1:*

Columnar section, Piceance basin, Colorado

AGE	THICKNESS (FT.)	REMARKS
TERTIARY		
Green River formation	0-3,500	Produces oil and gas
Wasatch formation	500-3,300	Produces gas
Fort Union formation	1,500-2,200	Produces gas
Ohio Creek conglomerate	10-400	Produces gas
	Disconformity	
UPPER CRETACEOUS		
Upper Mesaverde (Farrer facies)	1,600-3,000	Produces gas
Lower Mesaverde (Neslen facies)	1,000-2,200	Produces oil and gas
Rollins sandstone member	50-300	Barren
Mancos shale	30-700	
Cozzette sandstone	0-230	Produces gas
Mancos shale	30-150	
Corcoran sandstone	0-300	Produces gas
Mancos shale	2,500-5,000	
LOWER CRETACEOUS		
Mowry shale		
Dakota group		Produces oil and gas on contiguous uplifts
	Disconformity	
JURASSIC		Produces oil and gas on contiguous uplifts

TABLE 1

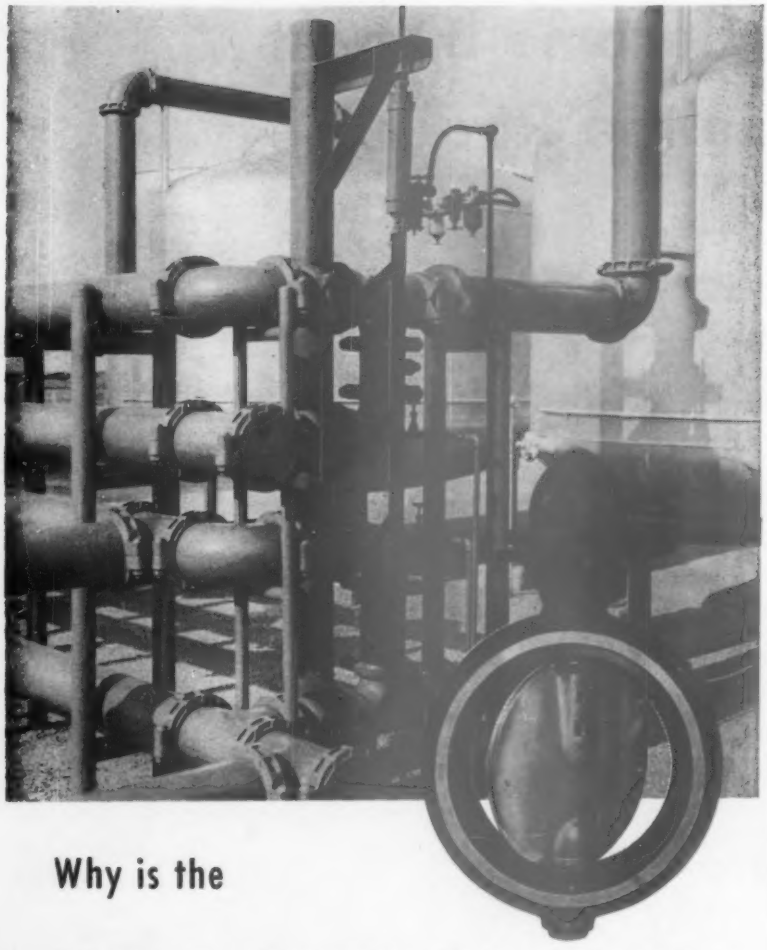
	1957	1958	1959	1960
Total wells	57	52	74	127
Total footage	197,069	233,216	303,775	504,220
Wildcat footage	124,832	158,137	171,729	254,046
Wildcat completions	33	33	36	57
Wildcat dry holes	24	24	25	45
Wildcat gas discoveries	7	9	9	10

*Statistics taken from Petroleum Information records.

It is interesting that 35 wildcat gas discoveries have been made in the 4-year period, and that the discovery ratio is almost 1 out of 3. It is also noteworthy that wildcat drilling is greater than development drilling—an unusual ratio because insufficient pipeline outlet is present to encourage exploitation of reserves already discovered. The trend that was established during the 4-year period from 1956 to 1960 has been continued during 1961 with considerable drilling to be completed during the favorable weather of the fall months.

Strictly defined, the Piceance basin should be described as that area of exposed Tertiary rocks in the above three and contiguous counties which is bounded by the almost continuous outcrop of the Tertiary-Cretaceous contact. Outside of this contact, the surrounding uplifts are exposed—Uinta Mountains and extensions on the north, Grand Hogback and the White River uplift on the east, the Uncompaghre uplift on the south, and the Douglas Creek arch on the west. Within this more accurately defined basin, a total of 178 wells have been drilled of which 91, or 51%, have been completed as gas wells. Only eight wells within the basin have penetrated both the Tertiary and Cre-

The author... Clark Millison graduated from Columbia University with a bachelor's degree in 1926 and from University of Oklahoma with a master's degree in science in 1927. His first assignment was with Shell Oil Co. from 1927-1936, where he reached the status of a regional geologist in the Kansas-Oklahoma region. Since 1927 he has been a consulting geologist with experience in all domestic U. S. areas except California and the Appalachians. Millison's foreign experience includes stints in Panama, Peru, Cuba, Mexico, Venezuela, and Argentina. From 1950-1955, he was a partner in the firm of Manhart, Millison, and Beebe in Tulsa. He has authored numerous professional articles and now resides in Englewood, Colo.



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taceous and none of these produced below the Mancos shale of Upper Cretaceous age.

It is estimated that in the deepest part of the basin near the Grand Hogback the basement is below 22,000 ft. Depth to the pre-Upper Cretaceous has discouraged exploratory wells to these zones although several potentially productive horizons are believed to be present.

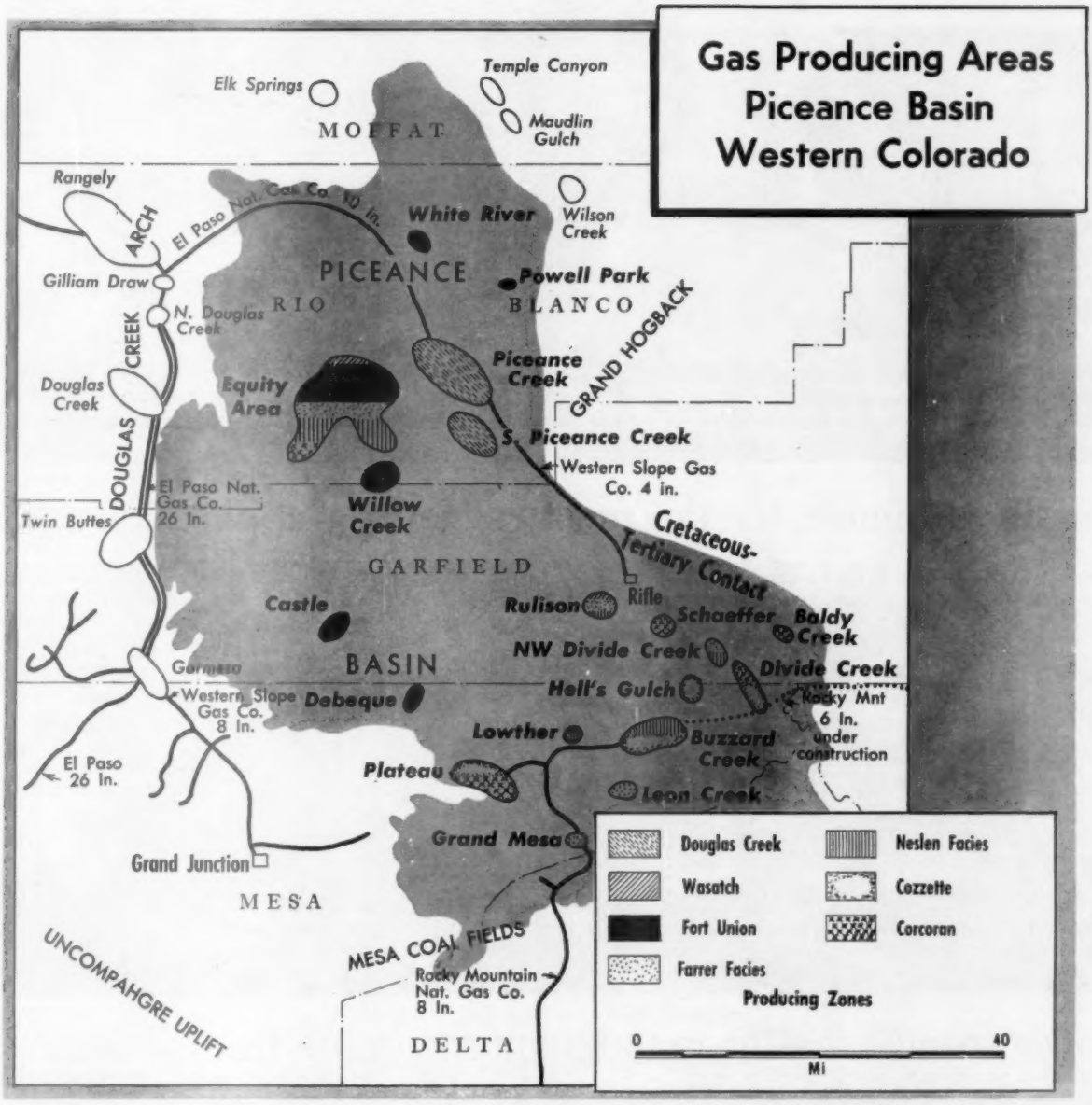
The basin contains about 3,900 sq. miles, or approximately 108 townships. Only one-half of the townships have wells drilled in them and many of these have been shallow Tertiary tests. Density of drilling is one well to every 22 sq. miles, and if three more closely-developed areas — Piceance Creek, Divide Creek, and Equity—are excluded, the density is only one well for every 35 sq. miles. It is evident that the basin is in the early stages of exploration and development, and there is a paucity of subsurface information.

On the west side of the basin near the Douglas Creek arch, the Wasatch-Ft. Union is about 500 ft. thick, while on the east side of the basin it is more than 5,000 ft. thick. Similarly, the Cretaceous near the Douglas Creek arch measures about 1,900 ft. and on the east side more than 6,000 ft. is present.

Correspondingly, there are thickness changes in a north-sourth direction throughout the basin. These variations are the result of the basin deepening and the surrounding uplifts emerging during the deposition of the Cretaceous and Tertiary beds. Such conditions cause many facies changes, convergences and divergences, and disconformities that, when buried, become a multitude of stratigraphic traps for the accumulation of gas.

Although there are many scattered gas discoveries and fields, only two are definitely closed anticlines: these are Piceance Creek and Divide Creek. Gas accumulation in these two fields is partly due to stratigraphic changes. Therefore, most of the gas accumulations are due to trapping in porous and permeable sandstone lenses or to changes in hydrodynamic gradients.

The lack of subsurface data is responsible for the disagreement among geologists familiar with the area as to correlations, depositional history, and other geologic factors.



HERE ARE the producing formations of Piceance basin. Although there are four pipelines serving the area, El Paso's line along the Douglas Arch doesn't go into the basin proper. With little effort, it could be extended for connection when needed. The Rocky Mountain 8-in. line from Buzzard Creek east has just been completed.

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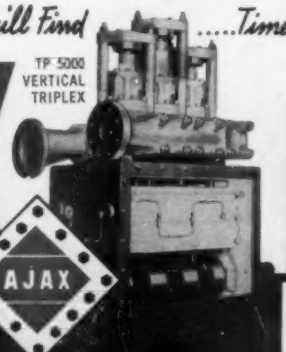

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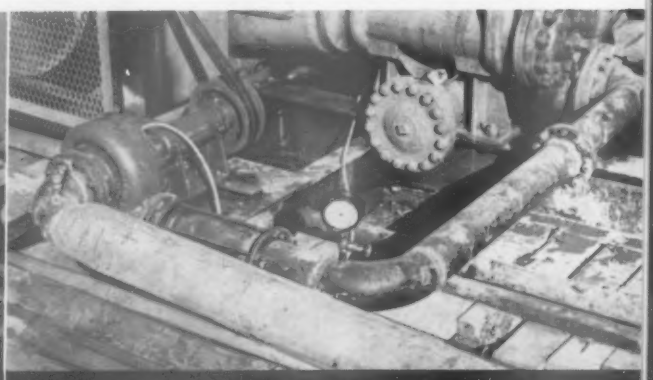

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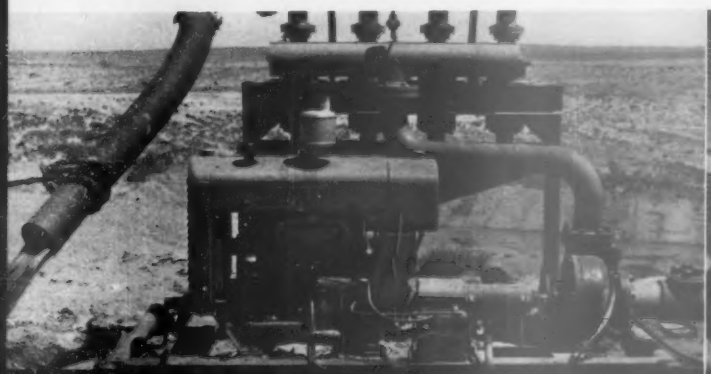

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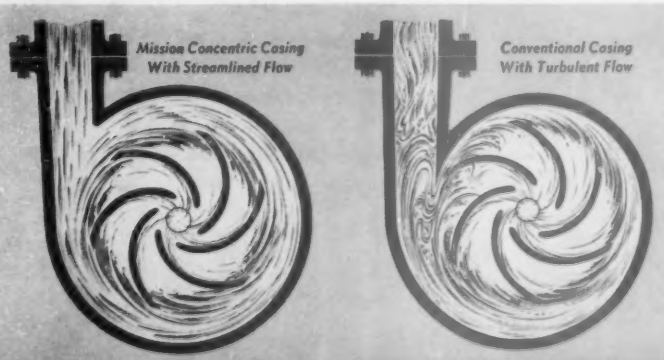

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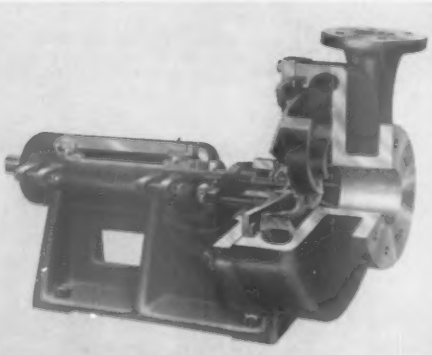

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Also, without adequate subsurface control, the geometric patterns of the potential gas zones cannot be mapped accurately. Careful assimilation and interpretation of every bit of new and additional information will produce rewards to the geologist who is well-founded in the present basic data.

Reservoir Rocks

The presently known gas-producing zones in the Piceance basin are in the Tertiary and Cretaceous sandstones. These sandstones have average to good porosities and low permeabilities. Techniques of detection, testing, and completion must be improved to exploit adequately the large gas reserves that must be present.

In the Equity gas-producing area, the Wasatch-Ft. Union of Tertiary age contains the principal gas zones, although gas production is also obtained from the Cretaceous rocks.

In the southern part of the basin, the Cretaceous is the principal objective. The two oldest presently explored sandstones are the Cozzette and Corcoran which are tongues that extend eastward in the upper Mancos shale and pinch out in an almost east - west line along the southeastern margin of the basin. Every well drilled to these sandstones in the southern part of the basin has encountered gas, and it is possible that gas production from these sandstones will be found over an area of several hundred square miles.

There are at present at least 10 gas-producing zones in the Tertiary and Cretaceous. Anyone who is acquainted with the early history and geology of the San Juan basin of northwestern New Mexico will see many comparable situations.

The Piceance basin has produced about 24 billion cubic feet of gas to this date, and it is estimtaed that there are more than 450 billion cubic feet of gas reserves already discovered. There must be a tremendous unestimated reserve awaiting development near the present discoveries.

Not more than six or seven million cubic feet of gas daily are now being sold from the basin. Analysis of the gas ranges from 971 to 1,195 B.t.u., 81.46 to 97.20% methane, 0.50 to 8.44% ethane, 0 to 3.88% propane and minor amounts of heavier fractions. With only one exception, carbon dioxide and nitrogen are less than a few per cent.

Wellhead price for the gas ranges from 12 to 15 cents per thousand cubic feet. Costs of completed wells range from $50,000 to $150,000.

Four pipelines serve the basin: an El Paso 10-in. line from Piceance Creek gas field to the interstate line at Rangely; a Western Slope Gas Co. (subsidiary of Public Service Co. of Colorado) 4-inch line from Piceance Creek gas field southward to Rifle; a westward slope 8-in. southward along the Douglas Creek Arch through the Colorado River Valley to Grand Junction and Palisade; and a Rocky Mountain Natural Gas Co., Inc., 8-in. line from the southern part of the basin southward to towns in the Gunnison River Valley. Rocky Mountain Natural Gas Co., Inc., in October 1961, completed a 6-in. line eastward from the southern part of the basin to Glenwood Springs, Aspen, and the Roaring Fork valley.

A large demand and resulting pipeline construction, a fair price for the gas, and improved detection and completion techniques will be needed to define definitely the apparently large potential gas accumulations that are believed now to be present in the Piceance basin. In time, it should take its place as one of the large gas-producing basins of the Rocky Mountains.

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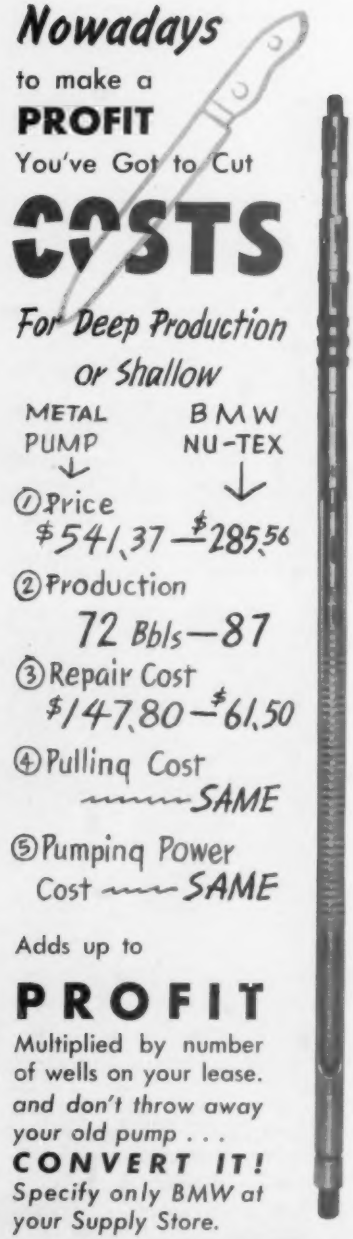
Pennsylvania adds two strikes

FOUR COMPLETIONS were reported in northwestern Pennsylvania. An outpost on the Indian Springs trend found 500 M.c.f.d. and a show of oil after fracturing the Red Medina Silurian. Rock pressure was 825 psi. The well was drilled by Grantley on the Rudy Andress farm in Spring Township, Crawford County.

A wildcat in Washington Township, Erie County, was drilled by Red Fern and Hurd on the Vanco farm. After fracturing, a show of gas in the Red Medina was reported, but the well was plugged and abandoned. Drilling went to the Queenston Upper Ordovician.

An outpost well in Conneaut field, Erie County, the 1 Rossiter, drilled by Pennsylvania Gas Co., found 3 M.M.c.f.d. of gas at a rock pressure of 1,010 psi. in 24 hours. The fourth well in the area was the Thomas Liben well, drilled by Bert Fields. It is a wildcat in West Salem Township, Mercer County. It was plugged and abandoned at 4,792 ft. after finding a show of gas and salt water in the Medina.

The other completions were in Cameron, Fayette, and Clearfield counties, Pennsylvania. New York State Natural Gas Corp. 4 Pardee estate, an outpost in Whiperwill pool, Cameron County, was plugged and abandoned after finding a show of gas and salt water in the Oriskany Lower Devonian. A Dubois pool well on the C. H. Prescott farm, drilled by Sylvania Corp. in Sandy Township, Clearfield County, found 1,345 M.c.f.d. at a rock pressure of 3,690 psi. in 63 hours in the Onondaga chert-Oriskany sand section. Fayette County got a discovery well at Peoples Natural Gas Co. and Snee & Eberly 1 Melvin Spruell flowed 3,100 M.c.f.d. at a rock pressure of 3,408 psi. in the Onondaga chert-Oriskany sand. The Spruell pool is located about 3 miles north of North Summit pool. An outpost of the East Summit pool drilled by the same operators failed to find commercial gas in the Oriskany and was abandoned.



New wildcats. Weaver Oil & Gas Corp. of Fort Worth has made three locations in the shallow oil and gas fields of Butler County.

These three wildcats are being watched with interest since it has been over 30 years since exploration for oil and gas last swept through this area.

Leasing. Leasing is still heavy in eastern Pennsylvania and New York. Humble Oil & Refining Co. has leased about 300,000 acres in Lackawanna, Susquehanna, and Wayne counties, Pennsylvania, and in Broome and Chemung counties, New York. Ohio Oil Co. has leased considerable acreage in Susquehanna County, Pennsylvania.

Three anticlines in Bradford, Sullivan, and Susquehanna counties have been leased solid. The northernmost anticline, Rome, has been checkerboarded by Mobil Oil Co. along the eastern end, leased solid by Pure Oil Co. along the western end, and leased to some extent by New York State Natural Gas Corp. and Tidewater around the town of Rome. The Towanda anticline has been covered by Shell Oil Co. from the eastern end toward the west. Pure Oil has leased solid from Towanda to the west and Mobil and Phillips Petroleum Co. have leased solid blocks on the western end. The Wilnot anticline has been leased solid by Shell and Pure. Pure has made location on the Wilnot anticline on the Charles Blenle farm in Wilnot Township, Bradford County. This is to be an 11,000-ft. wildcat to the Lower Silurian.

Pure is still leasing in the Valley & Ridge province. Texaco is leasing in Susquehanna County. There are five seismic crews operating in Pennsylvania this winter.

Boonsville Bend field in North Texas adds new pay

The Caddo lime is a new pay for Boonsville field in Parker County, North Texas. Christie, Mitchell & Mitchell completed 1 Wardell-Henderson flowing 45 bbl. of 41.1°-gravity oil per day through 20/64-in. choke. Perforations are at 3,749-52 and 3,774-80, 3,793-99 ft. in the Caddo Pennsylvanian lime.

Location of the new discovery is in the C. W. Blanton Survey, A-92, 4½ miles west of Stringtown. Suggested name is Blanton Caddo lime field.

Coke County. Sun Oil Co completed a confirmation to the IAB 5,100-ft. Pennsylvanian and Strawn reef field in northwestern Coke County, West Central Texas.

The 2-A Menille flowed 127 bbl. of 41.2°-gravity oil daily on 24/64-in. choke from perforations at 5,190-98 ft. Location is in Section 472, Block 1-A, H&TC Survey, 8½ miles northwest of Robert Lee. It lies 1,499 ft. southwest of the Sun 1-A Menille, a Strawn reef discovery well and the indicated second well in Northeast IAB field.

Foard County. Dwight M. Ross Drilling Co. has new conglomerate production in central Foard County, North Texas.

The 1 James A. Welch flowed 140 bbl. of 39.9°-gravity oil per day on 9/54-in. choke from the Daly conglomerate at 5,742-50 ft. Location is in Section 440, Block A, H&TC Survey, 4 miles north of Crowell. Nearest production is ½ mile south at Ross 1 Mooty in North Crowell Des Moines field. There is no conglomerate production in Foard County.

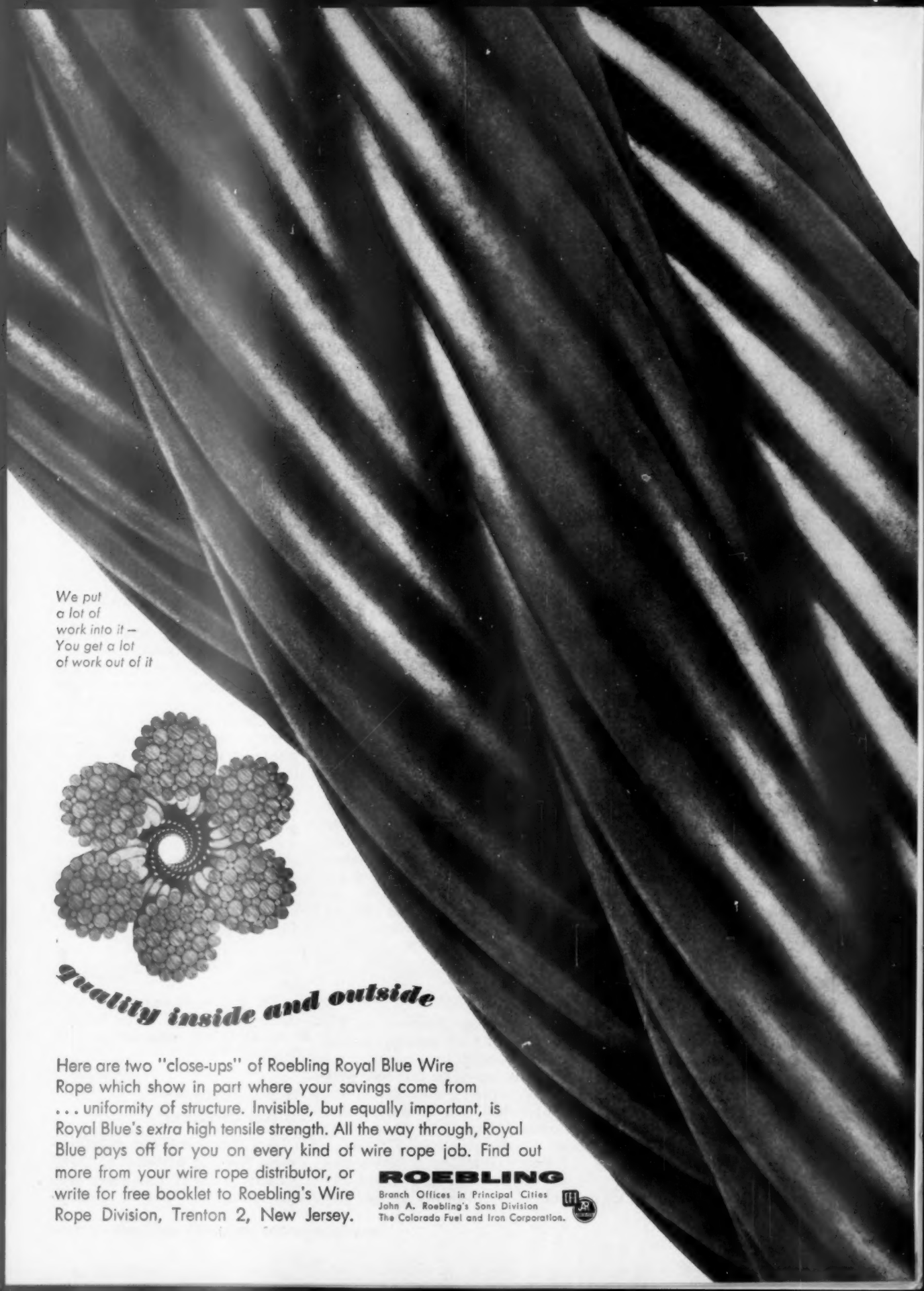
West Texas. Texaco 259 P. L. Fuller NCT-1, East Fuller field, Scurry County, is a new pay discovery from Canyon reef.

The well flowed 295 bbl. of 41.5°-gravity oil per day on 24/64-in. choke from reef perforations at 6,846-50 ft. Regular pay is Strawn Pennsylvanian. Location is 17 miles northeast of Snyder in Section 649, Block 97, H&TC Survey. Dual completion in Strawn is planned.

New oil pool opens in Ohio

In Ohio, a Clinton pool opener in southeast Baughman Township, Wayne County has been completed as a 30 bbl. producer.

This well, 1 D. J. Eberly, Sec. 25, was a joint deep test with Ohio Fuel Gas Co. and East Ohio Gas Co. participating. The target was the Cambro - Ordovician, drilled to a total depth of 6,536 ft. and dry. The Clinton sand encountered at 3,927-35 ft. had a showing of oil and hole was filled back to fracture this section. Final tests indicate initial production of 30 bbl. of oil per day.



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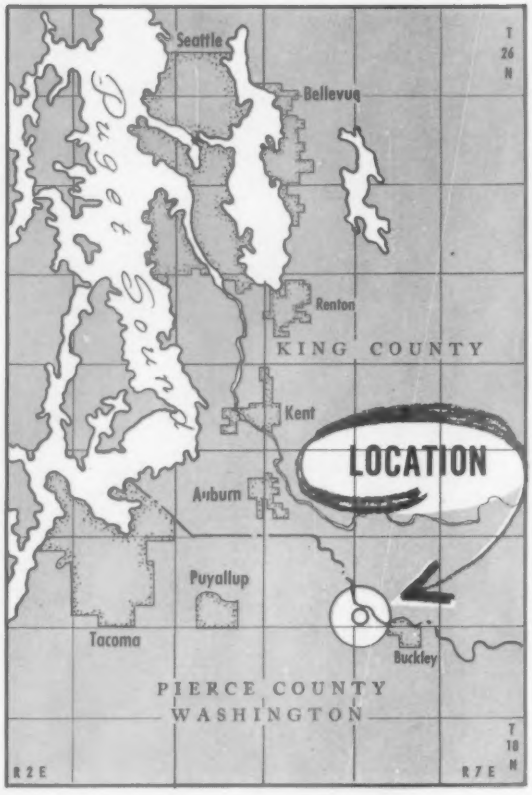
Washington's Puget basin will get wildcat

EDWARD J. CARR, Los Angeles, an independent, will drill a ±7,500-ft. Eocene Puget test near Lake Tapps, Pierce County, Washington. The location falls 16 miles east of Tacoma in 31-20n-6e and will be spudded about December 1, 1961.

The play is for Upper Eocene nonmarine Puget sands which have given up significant oil and gas shows in previous wells drilled in the basin. McCulloch Oil Exploration Co. of California drilled three 4,000 - 6,000-ft. wells during the late 1950's on the Kummer anticline about 5 miles northeast of Carr's location and found several partly oil-saturated sands. Some of the sands tested 3,000-md. permeability and up to 35% porosity.

The well will be located on a northwest - southeast - trending seismic high developed by Standard Oil Co. of California during the mid-1950's. The high has also been confirmed by both gravity and magnetic surveys. The seismic structure is covered with glacial debris in excess of 1,000 ft., but parallels similar northwest-southeast trending folds exposed in outcrop sections to the east.

J. Q. Anderson, Bakersfield, Calif., geologist, has been chiefly responsible for packaging the play and finding the buyer. The Lake Tapps prospect started out as a Standard of California play. Standard did the geophysical work and put together an initial acreage block of some 13,000 acres.



EXPLORATION will get a needed boost in the Pacific Northwest at a projected 7,500-ft. Eocene wildcat in Washington's Puget Basin. Edward J. Carr will drill the hole near Lake Tapps, Pierce County.

Anderson started working on the play in 1959 and first interested Occidental Petroleum Corp. in taking the play. Occidental assembled some additional top acrage but because of reported lease difficulties gave up their interest in the early part of the year. Anderson "took to the road again" this past summer and finally sold the play to Edward J. Carr, Los Angeles. Since acquiring the play, Carr has also put together additional acreage.

The block now includes some 26,000 acres covering two seismically defined domal highs. It is centrally located in the Puget Sound low and is located sufficiently westward from nonmarine Puget outcrops to suggest that interfingering marine strata could be present in the well section.

The Lake Tapps play is regarded as an excellent attempt to evaluate on structure a thick sedimentary section that has given up excellent shows of both gas and oil in past wells. The well will be followed with high interest by companies interested in exploratory work in the Pacific Northwest.

Texas ex-duster yields oil

An old abandoned hole in southern Houston County, Southeast Texas, has been turned into a prolific discovery well of Glen Rose oil production.

The well, 2 miles northeast of Fort Trinidad field, was deepened from its old total depth of 9,514 ft. to 12,026 ft. Glen Rose pay is perforated at 10,655-70 ft.

Deepening was by Pure Oil Co., and follows the discovery by this company of Glen Rose production at Fort Trinidad last January.

Production of the deepened well, 1 Paul Maples, is at the rate of 326 bbl. of 46.2°-gravity oil per day, flowing through ¼-in. choke. Flowing pressure registers 2,575 psi.

Pure's Glen Rose discovery well at Fort Trinidad field flowed 264 bbl. of 48.5°-gravity oil per day through ¼-in. choke from pay at 10,576-94 ft.

The new discovery has been designated as East Texas Trinidad field. It is 4½ miles northwest of Weldon.

South Texas well is gas producer

A wildcat a mile east of Fitzsimmons field, in northeastern Duval County, South Texas, has proved gas - productive from a 3,100-ft.

sand. Fitzsimmons field is oil productive from sands at 4,250 ft. and 3,600 ft.

The new well is Kirkwood Drilling Co. 2 J. M. Sepulveda. Openflow potential is 5,800 M.c.f.d. of gas. Shut-in pressure is 1,242 ft. Pay is perforated at 3,134-38 ft.

Location is 8 miles northwest of San Diego.

Texas' Alta Mesa taps new Frio pay

New Frio gas and condensate production has been opened in a wildcat completion 3 miles southeast of Alta Mesa field, in southern Brooks County, South Texas.

Nearest production at Alta Mesa is from Catahoula sand at 3,870-90 ft., making oil, and Vicksburg sand at 7,260-80 ft., making gas and condensate.

The Frio discovery is by Austral Oil Co., Inc., at its 1 C. G. Ramirez unit 6112, potentialed at 11 M.M.c.f.d. of gas with 12.8 bbl. of 60.5°-gravity condensate per M.M.c.f. Shut-in pressure is 2,542 psi.

Test flows ranged from 1,442 M.c.f.d. of gas through 10/64-in. choke with pressure of 2,489 psi., to 3,440 M.c.f.d. through 16/64-in. choke with pressure of 2,226 psi.

Location is 6½ miles southwest of Rachel.

More deep Edwards pay for South Texas

A deep Edwards oil producer has been completed in another discovery in South Texas' active Karnes County.

The new well, drilled by Coastal States Gas Producing Co., is just south of Falls City, and about 2 miles north of spreading deep Edwards production in Big John field.

It opens the seventh field in the county to produce from that horizon.

Coastal States' well, 1 Ben Lyssy, is rated good for 241 bbl. daily of 40°-gravity oil, flowing through ¼-in. choke under pressure of 490 psi. Gas-oil ratio is 524 cu. ft. per bbl.

Its producing zone is perforated at 10,258-80 ft. Total depth is 11,339 ft.

Kleberg County well hits shallow oil

Discovery of a new relatively shallow oil sand in the Ricardo area of Kleberg County, in South Texas, is reported by Coastal States Gas Producing Co.

The sand is productive at 2,901-

October footage breakdown in the U. S.

	Field wells					Wildcats			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	11,450								
Alaska	22,670		7,800	11,335					35,714
Arizona									876
Arkansas	55,304		6,850	49,349					38,274
California	443,292		110,279	80,482	6,308			13,965	150,242
Colorado	17,143	5,860	88,029	69,561		10,395	7,751	16,518	150,760
Florida									7,871
Illinois	181,616		3,178	122,273	171,134	13,152			78,740
Indiana	45,506			42,164	4,880	4,300			41,109
Kansas	499,808		49,261	303,889	12,109	16,289		12,000	202,746
Kentucky	41,914		84,600	89,382	6,791	3,736			25,329
Louisiana	822,879	77,364	365,502	544,148		9,800	24,685	25,703	413,783
North	188,137		113,736	107,161					147,466
South	515,116	77,364	229,768	377,520		9,800	24,685	11,400	190,783
Offshore	119,626		21,998	59,467				14,303	75,534
Michigan	40,224		15,031	65,094	44,427	7,344		2,468	94,317
Mississippi	191,122		24,615	131,444		32,369			139,171
Missouri									2,631
Montana	63,298		2,952	35,084		1,000			85,485
Nebraska	127,811		4,652	88,841		4,815			159,356
New Mexico	340,749		320,103	153,318		41,803			88,469
West	57,750		288,168	14,815		16,041			25,915
East	282,999		31,935	138,503		25,762			62,554
New York	17,550		6,663	3,576	13,500			11,582	5,820
North Dakota	36,766			15,594					51,783
Ohio	143,243		49,071	49,328	7,142			3,254	5,054
Oklahoma	1,049,595	36,727	258,692	385,869	98,502	21,892	12,942	13,169	103,328
Pennsylvania	46,211		54,686	3,524	22,011			20,294	25,184
Texas	2,549,033	78,874	646,581	558,924	102,170	141,320	45,017	156,197	1,135,407
District 1	91,506		8,114	21,268		2,782		3,757	94,557
District 2	59,202	9,806	92,627	67,662		10,670	9,017	51,181	123,687
District 3	267,136	10,210	64,254	76,894				9,599	128,370
District 4	214,696	16,034	165,482	64,811		15,637		46,067	197,037
East (5 & 6)	322,171	12,947	49,774	28,294		11,188	13,704		116,708
District 7-B	168,530	2,240	20,852	71,364	10,755	20,145		3,005	86,309
West (7-C & 8)	1,010,067		69,416	115,144	38,371	50,333	11,596	20,947	179,618
District 9	286,870	12,337	38,776	70,363	47,614	10,790			135,262
District 10	128,855	15,300	137,286	53,124	5,430	19,775	10,700	21,641	73,859
Utah	16,876	17,558	26,285	11,123			11,143	6,524	51,752
Washington									3,009
West Virginia	23,194		111,800	53,427	6,950			10,805	
Wyoming	85,341		17,610	36,262	250	5,582	7,115	5,185	203,087
Total	6,872,595	216,383	2,254,150	2,903,991	496,174	313,797	108,653	297,664	3,299,297

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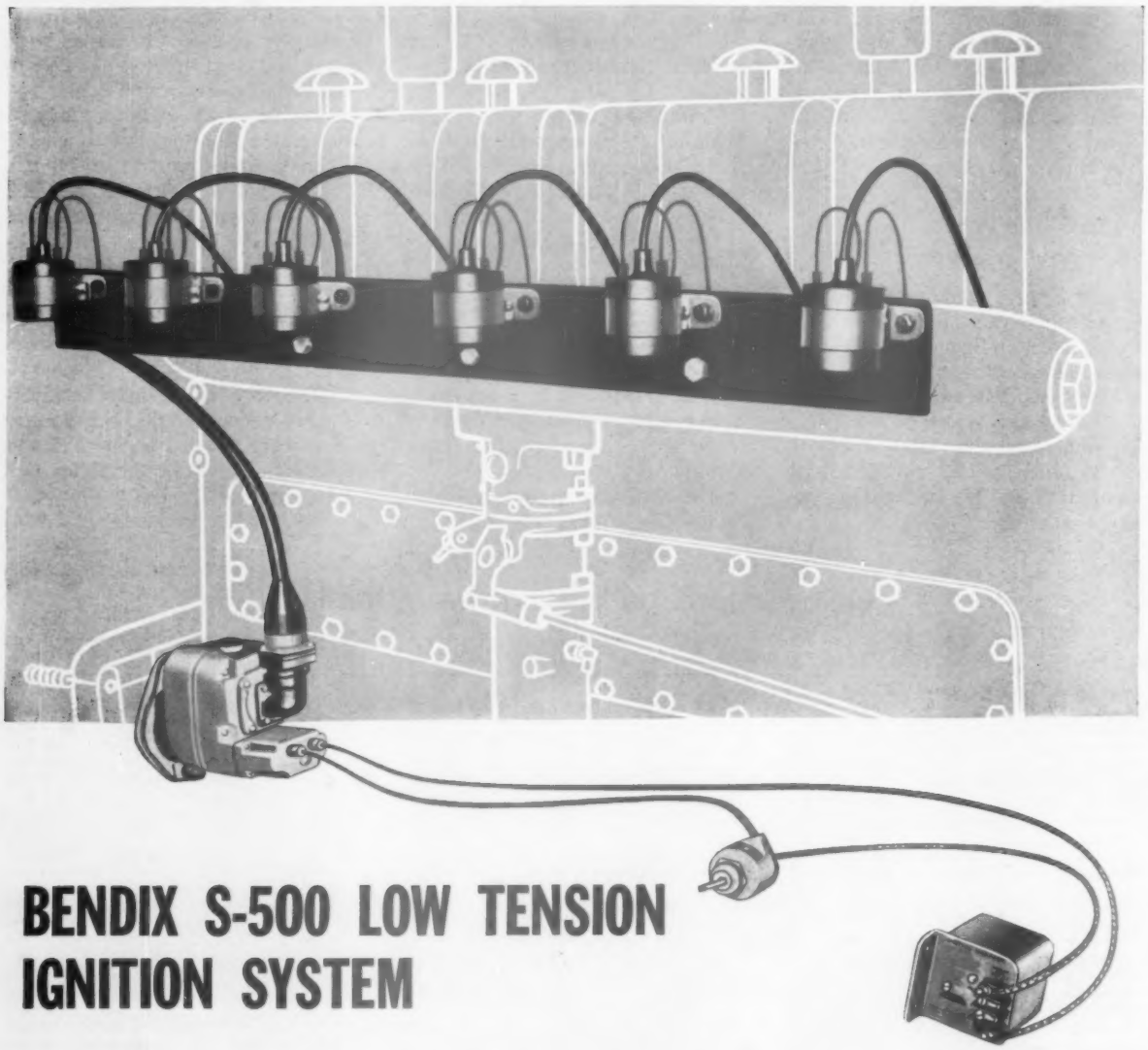

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12 ft. Nearest other production, ½ mile west, is from Frio sands at 5,730-40 ft. and 6,170-6,200 ft. The 5,700-ft. sand is oil productive but the deeper makes gas and condensate.

The new discovery well, 2 Henry, flowed 82.8 bbl. of 21°-gravity oil daily through 10/64-in. choke.

Sparta sand produces in Mississippi strike

Sparta sand, previously productive in only three other Mississippi fields, is the pay zone of a newly completed discovery well in Adams County.

All previous Sparta production in the state is in the same county.

The new discovery by Griffin & Keary is a half mile north of the abandoned Pellucid Creek field where production has been from the deeper Wilcox horizon.

Griffin & Keary's well is their 1-B U. S. A. Pay is perforated at 3,990-91½ ft. It tested for 67 bbl. of oil daily, flowing with pressure of 125 psi. Gravity of the oil is 30°.

Mississippi Magee stretches southeast

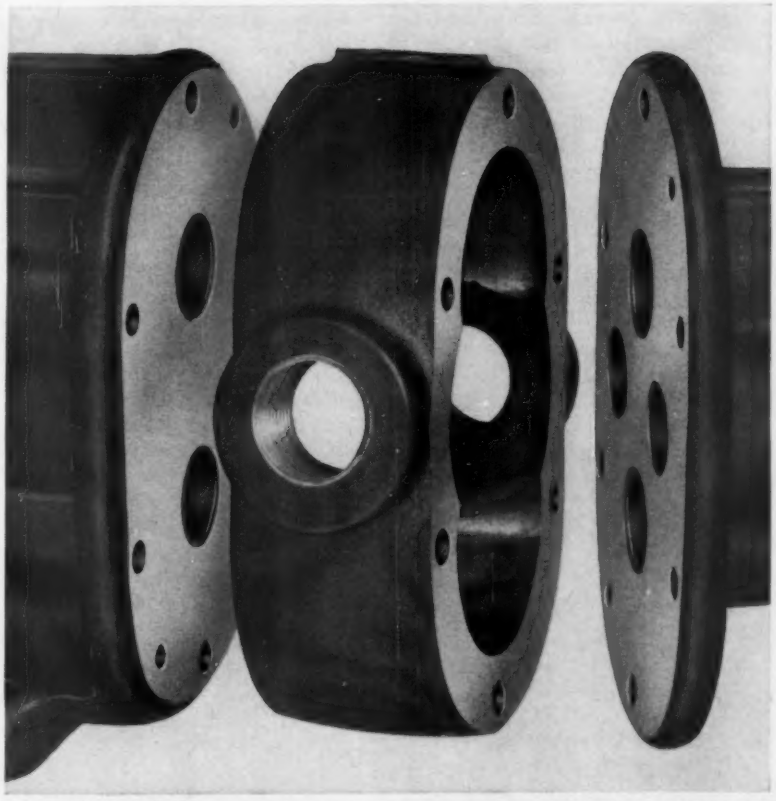
Mississippi's large Magee field in Smith County has a significant extension in a dual-zone Lower Cretaceous well a mile southeast of the main field in a new Graben segment.

The well (1 Hough) is a joint operation of Cities Service Petroleum Co. and Continental Oil Co. The two pay zones are the Rodessa, perforated at 13,098-13,118 ft. and 13,126-47 ft., and the Sligo-Womack sand, perforated at 13,773-93 ft.

Flow from the Womack was at the rate of 257 bbl. of 44.2°-gravity oil per day through 9/64-in. choke with pressure of 1,875 psi. The Rodessa zones tested 2,340 M.c.f. of gas and 4/4 bbl. of 44.4°-gravity condensate per day through 9/64-in. choke with pressure of 3,450 psi.

Big Texas field grows bigger

Big Brown-Bassett field in Terrell County, West Texas, was extended 3 miles northwest at Shell Oil Co. 1 Shell-Sinclair, Scott, & State.



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The well flowed 3,950 M.c.f.d. from Fusselman Silurian at 13,280-90 ft. Dual completion will be affected in the Ellenburger through open hole. Location is in Section 10, Block R, TCRR Survey, 20 miles south of Sheffield.

Connell discovery. Shell 1 Noelke is a new gas-condensate discovery in northern Terrell County, 3 miles south of Sheffield.

The well flowed 4,009 M.c.f.d. through 20/64-in. choke plus 81 bbl. condensate. Location is in Section 2, Block A-2, TCRR Survey. It lies 2½ miles southeast of Devonian gas at Yucca Butte multipay field in Pecos County.

Big Ellenburger producer completed in West Texas

An Ellenburger discovery is reported in Lowe Silurian field, 17 miles southeast of Andrews in Andrews County, West Texas.

David & Inez G. Fasken 1-S Fee, Section 26, Block 40, T-2-N, T&P Survey, flowed 1,116 bbl. of 52°-gravity oil daily on choke from perforations in the Ellenburger at 13,206-22 ft. From Silurian perforations at 12,725-75 ft., it flowed 726 bbl. of 48°-gravity oil per day on 20/64-in. choke. Total daily output at the dual completion is 1,842 bbl.

Louisiana well taps Tuscaloosa

Discovery of Tuscaloosa oil production is reported in a wildcat drilled by the estate of William G. Helis east of Justina, in Tensas Parish, eastern Louisiana. Nearest other production is 2 miles north in Justina field.

The new discovery well, 1 Fred Smith, flowed 40.2°-gravity oil while cleaning through 7/64-in. choke. Although the volume was unestimated, flow was under pressure of 1,200 psi. and indicated a good well. Pay is perforated at 8,563-78 ft.

British Columbia gets two more strikes

Two oil discoveries are indicated in the general Boundary Lake region of northeastern British Columbia about 30 miles east of Fort St. John.

Sinclair Canada Oil Co. et al. 16-34-83-14 Flatrock, LSD 16, 34-83-14w6, found oil at 4,465 ft. The 9-22-73-14 Flatrock, LSD 9, 22-83-14w6, found oil at 4,420 ft. Pay is the Triassic "D" or Boundary Lake zone. Neither well has been tested as yet. Sinclair recently bid over 1 million dollars for lands in the area. The northern tract cost $164,000, while the other cost $851,-000.

North Puckett field extended east in Texas

The fourth producer in new North Puckett-Ellenburger field, Pecos County, West Texas, is Southern Minerals Corp.-General Crude Oil Co.-Continental Oil Co. 3 Jasper CSL.

The well flowed 17,500 M.c.f.d. from perforations in the Ellenburger at 9,958-10,028 and 10,094-10,118 ft. Location is 29 miles southeast of Fort Stockton in Block 104, Jasper CSL 1. It moves the field 1 mile east.

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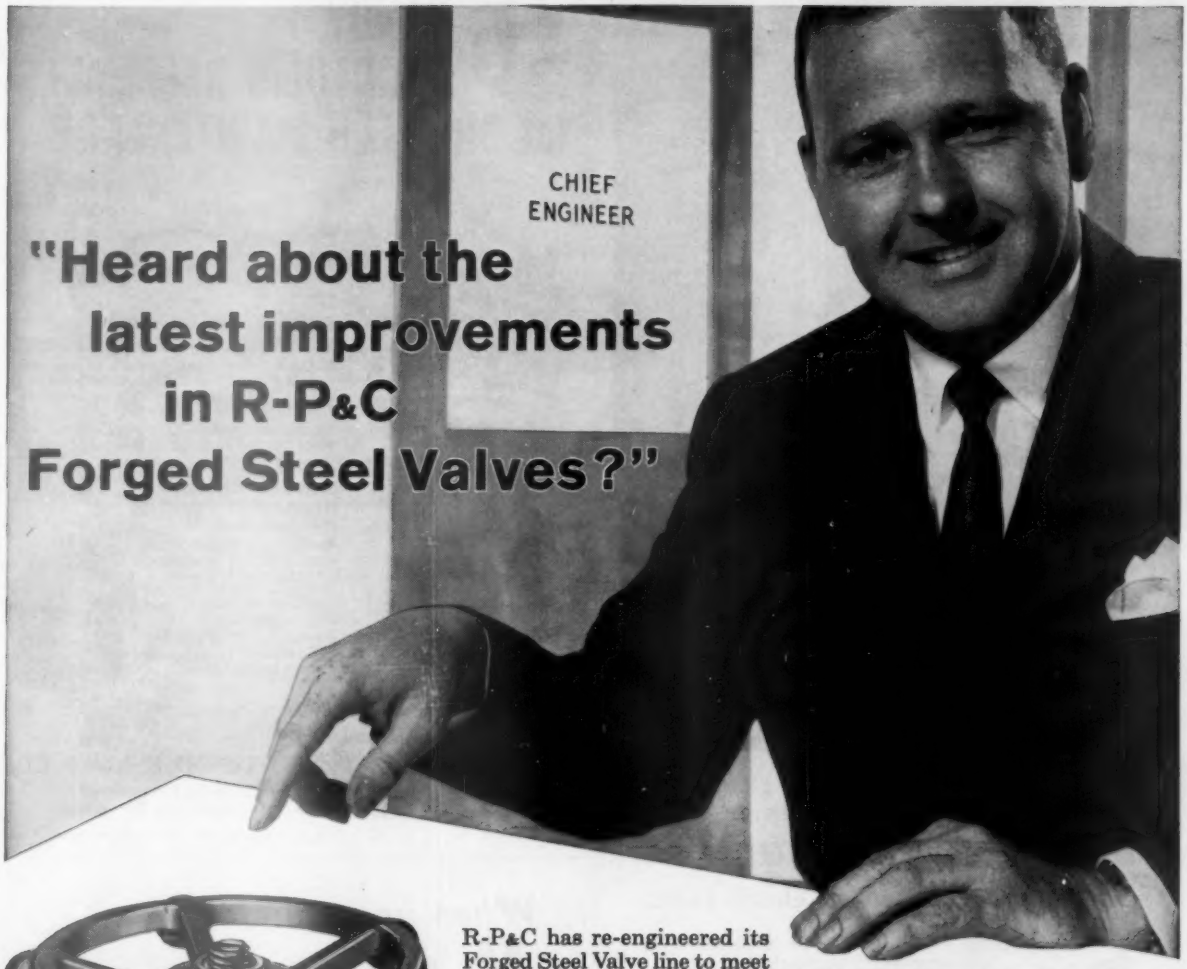

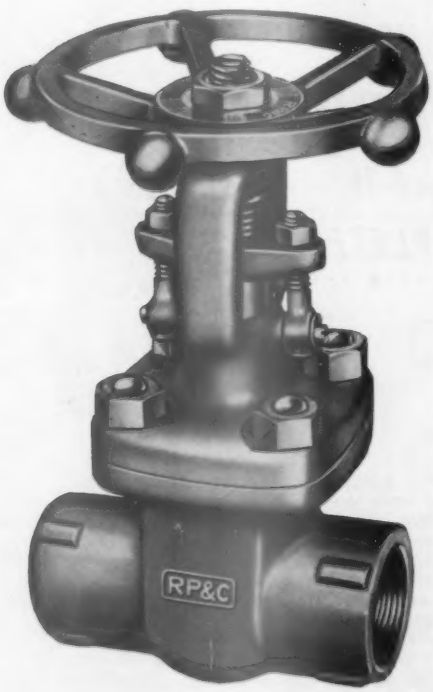

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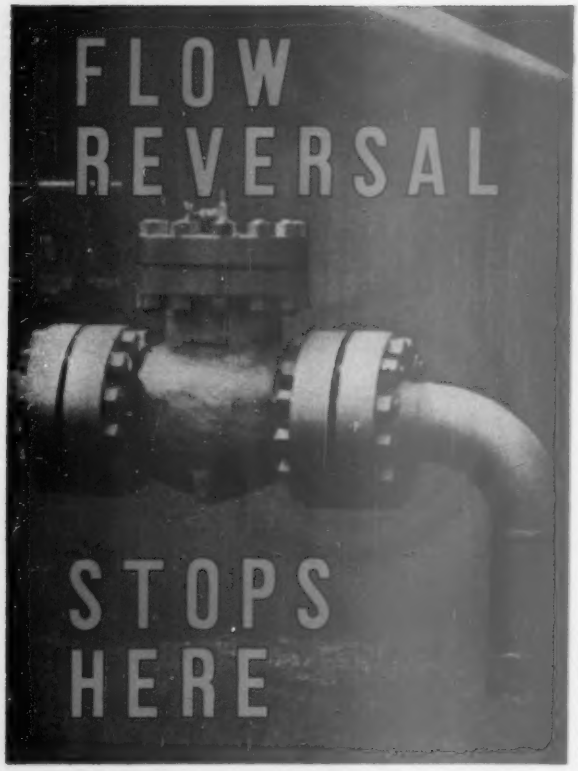

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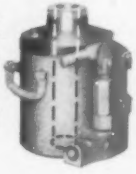

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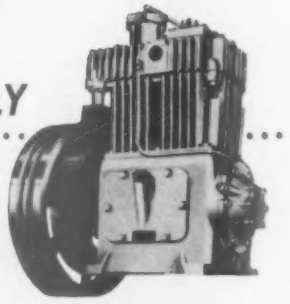

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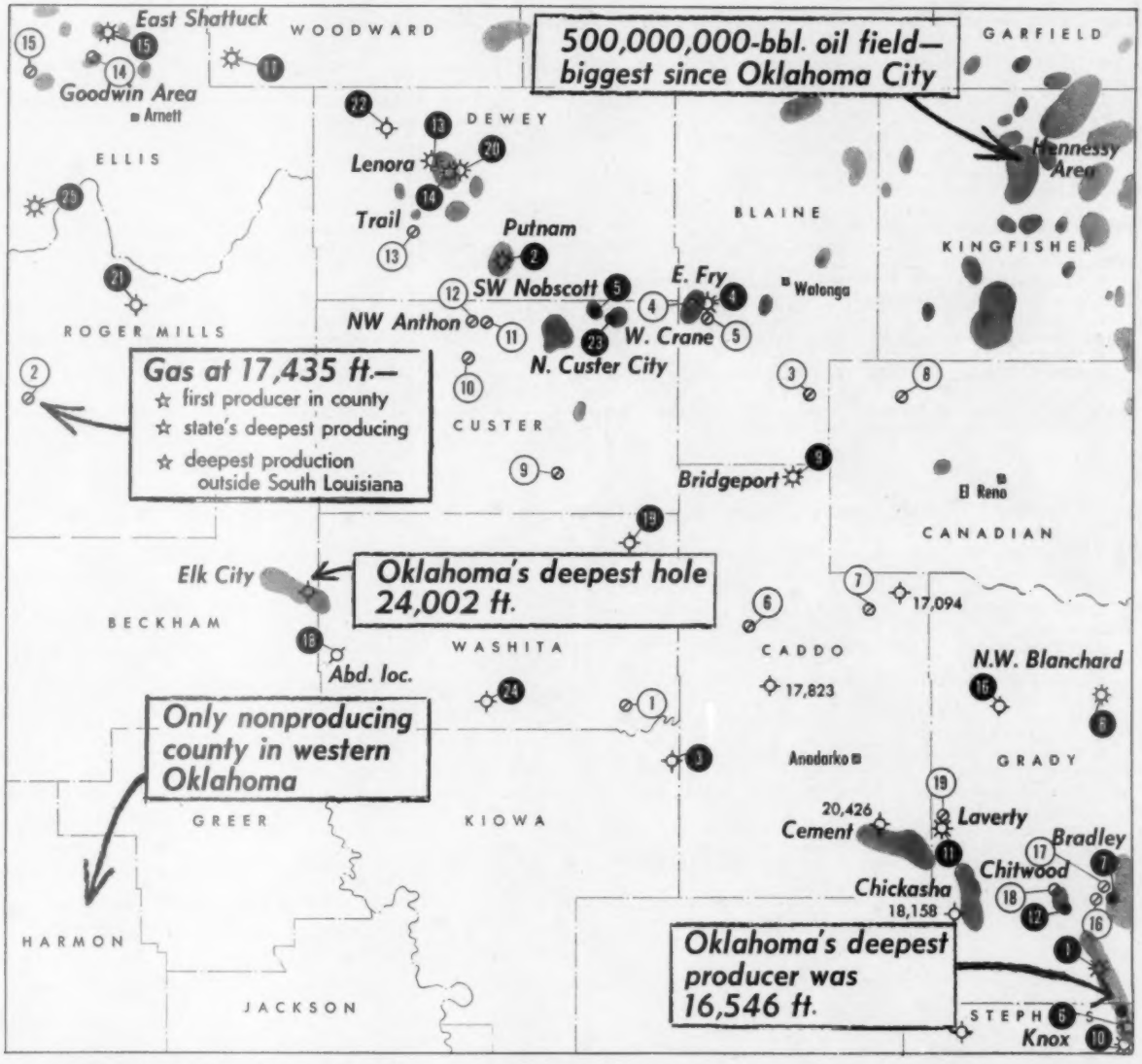

TWO PRODUCING-DEPTH RECORDS are possible in Oklahoma. Gulf Oil Corp. 1 Hartley in Roger Mills County flowed gas at 17,127-17,435 ft. If this one doesn't make it, Gulf's 1 Tabor in Washita County may with production found at 16,660-16,704 ft. Either will break the old record at Knox.

Ultradeep holes in Oklahoma

Shell Oil Co. Co., Elk City. TD 24,002 ft. D&A.

Superior Oil Co., Caddo County. TD 17,823 ft. D&A.

Denver, Caddo County. TD 17,094 ft. D&A.

Mobil, Caddo County. TD 20,426 ft. D&A.

Frankfort, Grady County. TD 18,158 ft. D&A.

Gulf 1 Wood, Grady County. Gas well. TD 17,000 ft.

Continental 1 North Corn unit, Washita County. TD 17,323 ft. D&A.

Humble 1 Schmidt, Washita County. TD 17,820 ft. D&A.

Gulf 1 Tabor, Washita County. TD 18,500 ft. Testing gas.

Gulf 1 Hartley, Roger Mills County. TD 17,556 ft. Testing gas.

Ellison 1 Miller-Long unit, Caddo County. OTD 21,021 ft. OWWO.

Gulf 1 Johnson, Grady County. TD 17,000 ft. Testing.

Deep drilling marks Oklahoma's Anadarko

OUTSIDE South Louisiana, the deepest drilling campaign in the nation today is in Oklahoma's Anadarko basin. Since the first of the year 25 wells have been completed below 10,000 ft. in western and southwestern counties; there are currently 20 wells going with depths below 10,000 ft. Half a dozen of these wells have gone below 17,000 ft. This is the most concentrated deep-drilling program yet undertaken in the Anadarko basin where sediments reach 30,000 ft. or more in thickness near the trough. It is along and near this trough that today's records are being made.

New producing-depth record. Commercial success at a wildcat in

Current deep wells drilling in Anadarko basin of Oklahoma (keyed to map with drilling symbol).

1. Gulf 1 Tabor, NE SW 24-8n-15w, Washita County. Gas discovery in Morrow at 16,704 ft. TD 18,500 ft.
2. Gulf 1 Hartley, NE NE NW 34-14n-26w, Roger Mills County. Gas discovery in Springer at 17,127-17,435 ft. TD 17,556 ft.
3. Wildcat. Sunray 1 McNeely-Fahl, Blaine County, C NE SW 17-14n-11w. TD 13,340 ft. Unton at 13,264 ft. WOC.
4. East Fry field. Texaco 1 Maier-Bolen, C SW NE 5-15n-13w, Blaine County. Drilling 12,032 ft. Tight hole. Chester 10,464 ft.
5. East Fry field. Texaco 1 Rice unit, C SW NE 10-15n-13w, Blaine County. Drilling at 10,383 ft. Red Fork 9,647 ft.
6. K. A. Ellison 1 Miller-Long unit, 4-9n-12w, Caddo County. OTD 21,021 ft. OWWO. Shut in.
7. Fain-Porter 1 Duncan, C SW NE 26-10n-10w, Caddo County. Drilling at 10,037 ft. Marchand Penn. at 9,832 ft.
8. Tidewater Oil Co. 1 Yellow, C NW SE 28-14n-9w, Canadian County. Testing 10,455 ft. Gas at 9,668 ft. in Atoka Penn.-Miss. at 10,350 ft.
9. Parker 1 Wagner, C NW SW 10-12n-16w, Custer County. Drilling at 15,630 ft. OWDD. OTD 15,606 ft.
10. Sunray 1 Hatcher estate, C SE NE 1-14n-18w, Custer County. Drilling at 16,208 ft. Meramec Miss. at 14,015 ft.
11. Hunt Oil Co. 1 Coit, Custer County, NW SE NW 17-15n-17w. Testing gas. TD 14,946 ft. Chester at 12,584 ft.
12. Hunt 1 Graft-Burmah, C SE NW 18-15n-17w, Custer County. Testing Morrow gas and upper Meramec. Sylvan Ordovician at 15,252 ft.
13. Humble 1 Saylor, SE NW 25-17n-19w, Dewey County. Fishing. TD 12,412 ft. Atoka 11,025 ft.
14. Pan American 1 Kirmse unit, C NE SW 14-20n-25w, Ellis County. Drilling at 10,467 ft.
15. Mobil 1 Vincent unit, C NW SE 27-20n-26w, Ellis County. Testing. TD 11,274 ft. Chester 11,228 ft.
16. Gulf 1 Morris, NE NE SW 5-4n-5w, Grady County. Drilling at 13,849 ft.
17. Musgrove 1 Cummings, C SW SW 33-5n-5w, Grady County. Testing. TD 14,542 ft. Tulip Creek Ordovician at 14,402 ft.
18. Mobil 1 Craddock, C NE NW 33-5n-6w, Grady County. Cond. mud. Top Third Bromide 16,553 ft.
19. Laverty area. Gulf 1 Johnson, SE NE SW 20-6n-8w. Testing. TD 17,000 ft. Springer.
20. Woods Petroleum Co. 1 House, C SE 22-2n-8w, Stephens County. TD 15,000 ft. (Miss. contract depth). DST at 10,203 ft.

Deep (below-10,000-ft.) wells completed in Anadarko basin 1961 (keyed to map).

1. Knox field. British-American 1 McKinney-Woods, 17-3n-5w. Gas at 15,408-15,664 ft. in Third Bromide Ordovician sand. TD 15,750 ft.
2. Putnam field. Union 1 Irwin, 10-16n-17w. Gas in Oswego Penn. at 9,515 ft. TD 11,512 ft.
3. Wildcat. Sohio 1 Martin-Morrow, 24-7n-14w. D&A. TD 10,050 ft.
4. East Fay field. Texaco 1 Winter unit, 3-15n-13w. Morrow Penn. gas at 10,298 ft. TD 10,445 ft.
5. Wildcat. Mobil 1 Dobbins, 9-15n-15w. Oil in Oswego at 9,800 ft. TD 14,405 ft.
6. Knox field. Sinclair 1 Moody, 13-2n-5w. Gas in Second Bromide at 15,784 ft. TD 16,282 ft.
7. Wildcat. Musgrove 1 Godfrey "C," 4-4n-5w. Oil at 14,104 ft. in Bromide. TD 14,553 ft.
8. Northwest Blanchard field. Cleary 2 Hilltop unit, 17-8n-5w. Bromide gas at 11,837 ft. TD 11,909 ft.
9. Wildcat. Mobil 1 Weathers, 8-12n-11w. Cherokee Penn. gas at 11,388 ft. TD 12,337 ft.
10. Southeast Knox field. Gulf 1 Graham, 25-2n-5w. Third Bromide gas at 15,738 ft. TD 15,900 ft.
11. Wildcat. Gulf 1 Wood, 29-6n-8w. Gas in Cunningham Penn. at 16,350 ft. TD 17,000 ft.
12. Chitwood field. Kidd Williams 1 Godwin unit, 10-4n-6w. Oil in Boatwright Penn. sand at 12,558 ft. TD 12,601 ft.
13. Lenora field. Amerada 1 Seal unit, 17-18n-18w. Morrow gas at 10,538 ft. TD 10,710 ft.
14. Lenora field. Amerada 1 Staub, 22-18n-18w. Morrow gas at 10,458 ft. TD 10,503 ft.
15. East Shattuck field. An-Son 1 Ehrlich unit, 31-21n-24w. D&A. TD 10,251 ft.
16. Wildcat. Blackwell 1 Coleman-Davis, 20-8n-7w. D&A. TD 14,134 ft.
17. Wildcat. Cabeen 1 State, 16-20n-22w. D&A. TD 10,786 ft.
18. Wildcat location abandoned by Shell in 28-9n-20w.
19. Wildcat. Continental 1 North Corn unit, 19-11n-14w. D&A in Chester Miss. TD 17,323 ft.
20. Lenora field. Amerada 1 Thomsen unit, 24-18n-18w. Morrow gas at 10,326 ft. TD 10,390 ft.
21. Wildcat. El Paso 1 Young, 3-15n-24w. Temp. abd. TD 11,840 ft.
22. Wildcat. Pan American 1 Buck unit, 28-19n-19w. D&A in Chester. TD 10,670 ft.
23. Wildcat. Mobil 1 Horton, 14-15n-15w. Oil and gas in Oswego and Meramec Miss. at 9,722-78 and 13,192-13,360 ft. TD 14,869 ft.
24. Wildcat. Humble 1 Schmidt, 20-8n-17w. D&A. TD 17,820 ft.
25. Wildcat. El Paso 1 Eggleston, 11-17n-26w. Gas-cond. in Tonkawa Penn. at 7,910 ft. TD 13,079 ft.

Roger Mills County will take the year's honors for the outstanding discovery in the Mid-Continent region.

Gulf Oil Corp. is testing gas at the 1 Hartley, NE NE NW 34-14n-26w, just east of the Texas line in Roger Mills County. The operator had 2,250 M.c.f.d. through ½-in. opening while testing in the Springer Pennsylvanian at 17,127-17,435 ft. If this old well drilled deeper is completed as a producer, it will set many new drilling records for Oklahoma.

1. Gulf's well will open Roger Mills County to production (the last in the basin).
2. It will leave Harmon County as the only barren area in western Oklahoma.
3. The 1 Hartley well will give Oklahoma its deepest producer.
4. The Gulf wildcat will be the deepest Pennsylvanian production anywhere.

Late note: Gulf has now plugged back to 15,148 ft. and is testing at that level. Completion at the record depth therefore is unlikely.

A quick followup. Gulf in the same week announced gas success at another deep Anadarko basin wildcat. The 1 Tabor in NE SW 24-8n-15w, 8 miles northwest of West Carnegie field, Washita County, flowed 3 M.M.c.f.d. on 1-in. choke from Morrow Pennsylvanian openings at 16,660-16,704 ft. If the Hartley well fails to produce commercially, the Tabor discovery will become the state's deepest producer.

Earlier this year. Last spring Gulf gave the state a deep producer at its 1 Wood wildcat in Grady County.

This well flowed 5 M.M.c.f.d. and 30 bbl. condensate per million from Pennsylvanian at 16,180-16,376 ft. Total depth is 17,000 ft. All three Gulf wildcats are right in the basin trough.

Another new deep discovery in western Oklahoma is El Paso Natural Gas Co. 1 Eggleston, C SE NW 11-17n-26w, 3 miles north of the Roger Mills County line.

This well flowed 4,180 M.c.f.d. and 13 bbl. condensate daily from perforations in the Tonkawa Pennsylvanian sand at 7,860-7,910 ft. Location is in a remote producing area of the county and state. Total depth is 13,079 ft. Shut-in tubing pressure was 2,178 psi., casing pressure 2,205 psi.

A long road. Many years of exploration in the Anadarko basin

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See next pages for information on new National Type G Hook Blocks

NATIONAL

NATIONAL SUPPLY ANNOUNCES A NEW STREAMLINED TYPE G HOOK BLOCK

New National Type G hook blocks are the culmination of years of design development and testing in field applications. They are completely streamlined for safety and efficiency. The new hook blocks are now offered in four sizes, with ratings from 100 tons to 500 tons. Here are some of their outstanding features:

FULLY UNIVERSAL CONNECTION between hook and block. A crosshead is provided with integral trunnions extending through and supported by the side plates. Hook and block assemblies are quickly disconnected for shipment by pulling the crosshead pin.

BUILT-IN HYDRAULIC SNUBBER prevents bouncing of drill pipe stands when spinning out and consequent costly damage to tool joint threads.

CONSTANT TORQUE POSITIONER. This device, which is standard equipment, keeps the drill pipe elevator from rotating out of position when it is going up empty. Derrick man can latch the elevator easily and is less likely to miss stands.

IMPROVED TONGUE CONSTRUCTION. Each tongue has a smooth, uninterrupted bail contacting surface which is contoured to properly support and protect the swivel bail. Tongue of the hook block is automatically latched when the swivel is picked up and cannot be opened accidentally.

TAPERED ROLLER BEARING SHEAVES. Sheaves are independently mounted on double row, tapered roller bearings that reduce sheave friction to a minimum. Rope grooves are machined in accordance with A.P.I. recommendations and are flame hardened.

CONVENIENT ROTATION LOCK. Each hook block has a rotation lock that will either lock the body in any one of eight equally spaced positions or permit free rotation.

STREAMLINED DESIGN minimizes the possibility of the block's catching on finger boards or other mast or derrick projections. All screws, nuts and levers are recessed and securely locked in place for maximum safety.

These are just a few of the features of the new National Type G hook blocks. Get complete details by contacting your National Supply representative, or writing to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

NEW TYPE G HOOK BLOCKS

	330G100	435G175	540G250	545G350	650G500
Number of sheaves	3	4	5	5	6
Sheave O.D., in.	30	35	40	45	50
A.P.I. rating, tons	100	175	250	350	500

National is also currently offering a line of five separate H hooks with ratings similar to the new G hook blocks. The hooks have conventional bails which can be used with any traveling block having a regular lower clevis.

Type G Hook Blocks are made heavy so they will fall freely. Short design provides maximum crown block clearance.

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See next page for information on National Swivels

- **Uniflex Wash Pipe Packing Assemblies**
- **Quick-Seal Hose Connections**

TWO REASONS FOR SUPERIORITY OF NATIONAL SUPPLY SWIVELS

Field tested Uniflex wash pipe packing assembly of National Supply swivels incorporates a free-floating type wash pipe that provides an improved method of packing off the mud. Packing is unitized cartridge type. Light weight of the assembly and quick-breaking threads speed replacement. Assembly can be installed without removing gooseneck or hose connections.

Quick-Seal hose connection features large, quick-breaking threads and uniform sealing elements to withstand rugged use. Design eliminates one hose connection member. All parts are made of steel and plated to resist corrosion and thread galling.

The Uniflex wash pipe packing assembly and the Quick-Seal hose connection are outstanding features of seven National swivels having comparative dead load ratings from 82 to 500 tons — and depth ranges extending from 1,000 ft. to 24,000 ft. There is a superior quality National swivel to meet any drilling requirement. Let your National Supply representative give you details, or write to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

National Supply also offers the new, small T-12 swivel, with an A.P.I. rating of 25 tons at 100 r.p.m. and a comparative dead load rating of 50 tons. It is used with small portable or trailer mounted rigs in exploratory, slim hole and shallow drilling, or on workover jobs.

Features are: • High strength-to-weight ratio • Low center of gravity • Precision line bored bail • Opposed Timken tapered roller bearings for true axial alignment.

Low center of gravity in streamlined National Supply swivels gives you greater stability in handling, easier and faster connection of sub to kelly.

ARMCO National Supply Division

have come up with but few large fields in the deeper portions. Elk City, Cement, Chitwood, and Knox are the best finds. The shelf areas have had considerable success as is true in most new basins.

Wildcatters have in the past been reluctant to jump into the deeper trough area of Anadarko. Suddenly in 1961 there appears to be a rush into the deep zones. The success ratio hasn't been bad either, considering the risk taken.

Huge reserves like those uncovered in Kingfisher up on the northeast side of the basin haven't been found yet in the western counties. But one by one in the past couple of years, western Oklahoma's nonproducing counties have fallen by the wayside. There is none left in the basin itself; only Harmon, which lies in the Hollis basin in extreme southwestern Oklahoma, lies oil and gas-barren.

Five years ago the western half of Oklahoma was almost empty of red and green dots. One of the industry's most interesting and expensive wildcat hunts is on in one of the largest oil and gas basins left for the drill. The rest of 1961 and the oncoming new year will bear watching in the Anadarko basin.

DISCOVERIES

Western Canada

Alberta:

B.A. et al. 12-17 Fenn, LSD 12, 17-36-20w4. D2 oil discovery. TD 5,675 ft.

Home-Baysel et al. 7-19 Enchant, LSD 7, 19-13-18w4. Basal Quartz gas discovery. TD 3,896 ft.

British Columbia:

Sinclair et al. 9-22 Flatrock, LSD 9, 22-83-14w6. Triassic oil discovery.

Sinclair et al. 16-34 Flatrock, LSD 16, 34-83-14w6. Triassic oil discovery.

North Louisiana

Bossier Parish:

Hadson Oil & Gas Co. 1 Welori-Crystal, C SE SW 9-20n-12w. IP 6,600 M.c.f.d., calculated open flow, 20 BC per M.M.c.f., 64.8°, shut-in TP 2,150 psi., perf. 5,832-42 ft., Hosston. TD 6,401 ft. New pay, and extends Benton field 1 mile southeast.

Catahoula Parish:

Olin Oil & Gas Corp. et al. 23 Olin-Tensas fee, C SW NE 31-6n-6e. IP 53 BOPD (net) 10% b.s. and w., 11/64-in., 39°, TP 70 psi., perf. 5,589-91 ft., Wilcox. TD 5,910 ft. Extends Long Branch field 1¼ miles northeast.

Jackson Parish:

Feazel Interests 1 Reynolds & Moore, 20-15n-3w, 2 miles northeast of Jonesboro. IP 3,390 M.c.f.d., 14/64-in., TP 3,100 psi., perf. 8,479-89 ft., Hosston. TD 9,095 ft. Discovery well of Jonesboro field.

South Louisiana

St. Mary Parish:

Placid Oil Co. 4 Shadyside, 64-15s-10e. IP 5,800 M.c.f.d., 14/64-in., perf. 14,-830-90 ft. TD 15,992 ft. Extends Patterson field 2 miles west.

East Texas

Anderson County:

Fairway Operating Co. 1 Vermillion unit, Jose Cherino Sur., A-168, 1 mile southwest of Frankston. IP 297 BOPD, 18/64-in., 53°, TP 700 psi., GOR 1,366 cu. ft. per bbl., perf. 10,194-10,206 ft., Pettet; and 395 BOPD, 12/64-in., 48°, TP 1,750 psi., GOR 1,480 cu. ft. per bbl., perf. 9,993-98 ft., James. TD 10,-464 ft. Second Pettet producer in Fairway field. Extends Pettet 4 miles southeast.

Henderson County:

Lone Star Producing Co. 1-B Allyn est., John Lawrence Sur., A-434, 3 miles west of Brownsboro. IP 1,080 M.c.f.d., calculated open flow, dry gas, shut-in TP 3,518 psi., perf. 10,653-11,658 ft., Cotton Valley. TD 14,503 ft. New-pay discovery in Opelika field.

Leon County:

R. H. Hedge et al. 1 Andrews, William Johnson Sur., A-11, 5 miles southeast of Leona. IP 191 BOPD, ¼-in., 38°, TP 500 psi., GOR 994 cu. ft. per bbl., perf. 7,868-74 ft., Woodbine. TD 7,931 ft. Discovery well of OSR field.

Texas Panhandle

Ochiltree County:

John J. Eisner 1-102 Auntie Mame, North Buler area, 12 miles southeast of Farnsworth, Sec. 102, Blk. 13, T&MO Survey. IPF 20 BOPD, ½-in. choke, 31°, FP 85 psi., Novi lime 8,160-80 ft. TD 9,550 ft. New oil discovery.

(Continued on Page 155)

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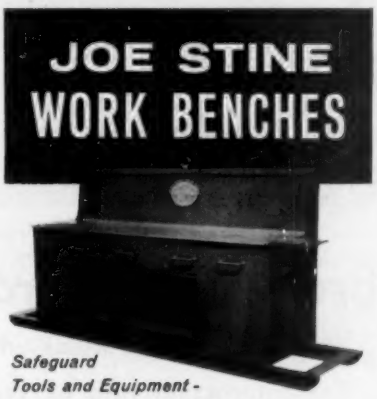
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PROFILE

PIPELINE executives,* all named Williams, are firmly convinced that . . .

Breaks come from teamwork

That's one of the ideas which have kept versatile pipeline-contracting firm of Williams Brothers on the move.

THE LATE Knute Rockne was coach at Notre Dame when the "Fighting Irish" became one of the great gridiron powers of all time. Rockne's highly successful coaching was grounded on sound principles.

One of those principles, as Rockne expressed it: "A good team makes its own breaks."

That tenet has helped to make Williams Brothers Co. one of the outstanding pipeline-contracting firms of the '60's. Williams Brothers is more than just what the classification "pipeline contractor" implies. One reason is that it often helps to make "its own breaks."

*David R. Williams, Jr., left; John H. Williams; Charles P. Williams.

It may be making its biggest break by sponsorship of the first mobile pipe mill. This device—which rolls, welds and strings pipe in 800-ft. lengths on the right-of-way—is undergoing its first field test in North Texas. It could be a revolutionary development in the history of pipeline construction, by making a tremendous impact on costs (OGJ, Dec. 4, p. 95).

John H. Williams, president, summed up a description of his company with the phrase, "vertically integrated." Five divisions make up this operation.

John is primarily responsible for two, the domestic and the oil-and-gas divisions. His brother, Charles P. Williams, has charge of the foreign division. David R. Williams, Jr., their cousin, handles the engineering division. The three are equally responsible for the fifth, the management division.

While each has a primary responsibility, all are expected to keep sufficiently well informed on the affairs of the other divisions so that decision-making authority in all divisions is always available. This interchangeability of the top officers of the company gives it an unusual flexibility.

The domestic and foreign divisions, responsible for construction in this country and abroad, are the principal operating divisions. However it is more often the other divisions that enable Williams Brothers, as a team, to "make its own breaks."

The company will continue to bid on pipeline projects where it believes it can make a profit and hopes "to be right at least 51% of the time." But it intends to escape dependence on this type of business. To do so it is searching out new avenues and new projects and, if advantageous, promoting them.

The various divisions give the company a wide range of opportunity to do this. It is in position to design and engineer a great variety of industrial installations, to conceive and execute projects, to assist in financing, and to participate in management.

One example of Williams Brothers' versatility was its selection by the Department of Interior to design and engineer the first major helium line. This 475-mile system from Bushton, Kans., to Amarillo, Tex., will pose entirely new problems in pipeline design and operation.

Two of its recent jobs are other examples of this versatility. One was the Mid-America Pipeline Co.

Jordan C. Braun, geologist with William H. Pine, Okmulgee, Okla. producer, has joined Skelly Oil Co. in Oklahoma City as geologist.

Lars Soderbergh, marine sales manager for Mobil Oil AB Sweden, has been named managing director of Mobil Sales (International), Ltd., and resident director for the Far East. He will headquarter in Tokyo. Soderbergh succeeds **Stig Host,** recently named general manager of Mobil International Oil Co.'s wholesale sales department in New York.

Howard W. McCall, Jr., first vice president of Chemical Bank New York Trust Co., has been elected vice chairman. McCall has been in charge of the bank's oil and gas division for many years.

V. E. Liles, Pan American Petroleum Corp. vice president, administrative, and a director, has retired after 34 years with the company and its predecessors.

Everett H. Bailey has been named assistant manager of Humble's New Orleans marketing area. He had been on special assignment in Birmingham, Ala.

2,200-mile system, the largest LPG pipeline ever built. It was a turnkey job—engineered, designed, and built by Williams Brothers. The other is the Calnev Products line from Colton, Calif., to Las Vegas, Nev. Williams Brothers participated in the conception, financing, design, and engineering of this line. It owns 27% of the Calnev stock.

The new management. Versatility has been the aim of the present management since it took over from an earlier generation in 1950. A radical step was taken in this direction in 1957 when Williams Brothers became a public company. Now 42% of the stock is held by others.

As a publicly owned corporation, it is the only pipeline contracting firm in the country with its stock quoted on the American Stock Exchange and the only one that must and does publish an annual report.

The three top men in Williams Brothers have a great deal in common, a fact which may contribute to the smoothness of their teamwork. All are graduates of Yale University's Sheffield Scientific School. John and David got degrees in civil engineering and Charles in applied economics.

All served with the armed services in World War II, but in different branches. Charles was with the Army Engineers and spent much of his time in the China-Burma-India theater when the pipeline over the "hump" was built. John was with the Navy's Seabees, and served most of his time in the Pacific. David was a fighter pilot in the Air Force, and occasionally flies his own plane now.

Both John and Charles spent most of the first 20 years of their lives in Cuba, where their father owned an importing firm. They speak Spanish fluently and are experienced in the ways of doing business outside the United States.

Charles had a taste of public accounting in New York before joining Williams Brothers in 1940. He first worked as a timekeeper and later as a field office manager. His first foreign work was in Venezuela in 1942.

After John left school, he joined Southeastern Pipe Line Co. He was in charge of the Bainbridge terminal when one of the last notable battles between railroads and pipelines over right-of-way took place. One of the first big Williams Brothers jobs he worked on was the water line that spanned the Florida keys.

David, youngest of the trio, went right from school into the Army Air Corps. Much of his service career was spent flying fighter planes from English bases. When the war was over he took a job as an engineer with Williams Brothers, became a spread manager and later, a project manager.

Despite their relative youth—their ages range from 40 to 46—the three represent a considerable amount of pipeline experience. And they are as well traveled as they are experienced. David, for example, spends much of his time in Canada where Williams Brothers has been operating since 1923.

Williams Brothers Co. has a dozen offices outside the U. S. and there is regular personal contact between them and the Tulsa headquarters. The top management feels, too, that it should keep in personal touch with its far-flung operations.

At the moment these include such varied projects as a products line in Iran, a natural-gas line in Austria, a crude line in Indonesia, road-building in Paraguay and Panama, production in Bolivia, and a section of the Alberta-San Francisco gas line—the largest long-distance pipeline ever built.

Gordon Smale, geologist with Texaco, has been transferred to Columbus, Ohio, from Wichita.

Lowell D. Clark, assistant to the vice president of branded marketing for Kerr-McGee Oil Industries, has been named manager of the new branded-marketing services department. **P. C. Bennett** has been named manager of the station acquisition and construction department. **W. J. Fuchs,** formerly merchandising manager, has been given new duties in the minerals division.

W. O. Narry has been named manager of foreign sales for Richfield Oil Corp. He succeeds **B. D. Blanchard,** who has retired after 31 years with Richfield. Narry has been with the company since 1924.

PERSONALS

Gilbert Steile, engineer trainee with Ohio Oil Co. in Iraan, Tex., has been promoted to reservoir engineer in Bay City, Tex.

John G. Weinman, New Orleans, has been named to succeed **Lawrence D. Hinman** as a director of Eason Oil Co. Hinman has retired after 32 years with the company.

E. Paul Wilkinson has joined Union Texas Natural Gas Corp. as marketing manager for petrochemicals and special products. He had been with Houston Chemical Corp.

R. B. Williams has been promoted to section head in Humble's research and development department, Baytown, Tex.

Donald Walker, a production engineering supervisor in Mobil Oil Co.'s Lafayette, La., producing district, has been promoted to staff reservoir engineer in the Houston division office. Walker has been with Mobil since 1952.

Richard H. Vaughan, Occidental Petroleum Corp., Bakersfield, Calif., has been elected president of the San Joaquin Geological Society. **Thomas J. Brady,** Richfield Oil Corp., Bakersfield, has been named vice president, and **Stanley E. Karp,** Kern Oil of California, Ltd., Oildale, has been named secretary-treasurer.

Joe Cresce, director of manufacturing for Monsanto Chemical Co.'s Chocolate Bayou operations, has been transferred from St. Louis to the Chocolate Bayou plant site near Alvin, Tex. **James O. Harris,** research adviser for Monsanto's organic-chemicals division, has been named manager of rubber chemicals in the division's development department, Nitro, W. Va. Also, Monsanto has made several appointments in the development department of the new hydrocarbons division. **Dr. Norman J. Lewis** has been named assistant director of development. **Charles P. Fullerton** will be development associate and **Merlin J. Auzine, Peter D. Burland,** and **Robert B. Rodgers** will be project managers.

A. P. Shearer, manager of the eastern and commonwealth division in British Petroleum's refineries department, London, has been appointed general manager of BP Refinery (Aden), Ltd. Shearer has been with BP since 1930. He had held assignments in the Middle East and at the Middlesex, England, research center before becoming manager of the eastern and commonwealth refineries division in 1958.

Billy G. Cole, Sunray Mid-Continent Oil Co. geologist in Oklahoma City, and **Robin L. Lyon,** geologist in Salt Lake City, have been promoted to senior geologists. **Robert E. Garrison,** junior geologist in Casper, Wyo., has been promoted to geologist, and **T. E. Lofton, Jr.,** junior engineer in Shreveport, La., has been named engineer.

Harvey E. Boultinghouse, pipeline superintendent for Midwestern Gas Transmission Co. in Eau Claire, Wis., has been transferred to Ada, Minn., in the same capacity.

Dallas P. Raney, Little Rock, Ark., investment broker, has been elected a director of Arkansas Louisiana Gas Co.

Otway B. Denny, assistant district superintendent at Ferriday, La., for Humble Pipe Line Co., has been promoted to district superintendent there. He succeeds **J. B. Barnett,** who has retired after almost 48 years with Humble and its predecessors. Denny was on special assignment in Libya before becoming Ferriday assistant superintendent in August. He has been with the company since 1945. Barnett had been Ferriday superintendent since 1955 and had served in the same capacity at Magnolia, Ark., Raceland, Oxford, and Shreveport, La.

W. S. Gibson, superintendent of Interprovincial Pipe Line Co.'s district 5, Sarnia, Ont., has been named superintendent of district 1 with headquarters in Edmonton. **E. C. Irwin,** terminal and station foreman in Sarnia, will succeed Gibson as district superintendent there. **R. J. C. Dunsmore,** terminal foreman in Clarkson, Ont., will succeed Irwin. **F. E. Sirdevan,** assistant terminal and station foreman in Sarnia, has been transferred to Clarkson to succeed Dunsmore.

V. F. Neuhaus, chairman of the McAllen, Tex., State Bank and president of the First State Bank & Trust Co., Mission, Tex., has been elected a director of Houston Natural Gas Corp.

George F. Peck, Jr., has been named South Texas region manager in Waco, Tex., for Lone Star Gas Co.

D. L. Wiley, head of the polyethylene department at Union Carbide Chemicals Co.'s Texas City plant, has been transferred to New York as polyolefins production planner for Union Carbide Plastics Co., an affiliate. **Tom Kudro,** production engineer at Texas City, will succeed Wiley as polyethylene department head there. Wiley has been with the Union Carbide companies since 1951, Kudro, since 1952.

Cody R. Spencer, president of General Petroleums Drilling Co., Ltd., has been elected chairman of the company. **Ralph L. Binning,** executive vice president, will move up to president. Spencer, who founded General Petroleums in 1941, is also a director of Worldwide Drilling Co. and Commonwealth Petroleum Services. Binning has been with General Petroleums since 1948.

Joe Cox, Superior Oil Co., has been elected president of Denver Landmen's Association. New vice presidents of the group include **Jack Elliott,** Cabeen Exploration Corp.; **Art Lorfing,** Continental Oil Co.; **Gene O'Connor,** Texas Pacific Coal & Oil Co.; **Paul Rahe,** Gulf Oil Corp.; and **Jack Robbins,** Texaco.

Alfred John Williams, director of Saskatchewan Mineral Resources Department's petroleum and natural gas branch, has been named acting deputy minister of mineral resources. He will hold the post during the absence of **J. T. Cawley,** now on loan as adviser to the Indonesian Government.

C. H. Marlar, Jr., process engineer at DX Sunray Oil Co.'s Tulsa refinery, has been promoted to senior process engineer for Suntide Refining Co. in Corpus Christi, Tex. **Alvin B. Gilliam,** mechanical engineer with Suntide, has been named senior mechanical engineer. **Walter L. Swander,** junior process engineer at the DX refinery in Tulsa, has been promoted to process engineer there.

B. C. Shaul, assistant western division manufacturing manager for Tidewater Oil Co., has been named division manufacturing manager. He succeeds **Oscar Larson,** who has retired after 38 years with the company. Shaul, who joined Tidewater in 1929, had held his former post for 11 months. Before that time he was general superintendent of the Avon refinery, Martinez, Calif. He also has served as superintendent of engineering, maintenance and construction and process superintendent at Avon.

SHAUL

Thomas H. Marshall, retired vice president of the old Anderson-Prichard Oil Corp., has been reelected for a twelfth term as president of the Kansas-Oklahoma division of Mid-Continent Oil and Gas Association. New officers named at the division's annual meeting last week in Tulsa include **John P. Hammond,** Amerada Petroleum Corp., Tulsa, first vice president; **Ward S. Merrick, Jr.,** Ardmore, Okla., independent, vice president for southern Oklahoma; and **Jack H. Abernathy,** Big Chief Drilling Co., Oklahoma City, vice president for western Oklahoma. Reelected were **John F. O'Shaughnessy,** Lario Oil & Gas Co., Wichita, vice president for western Kansas; **Carl Weiner,** Chanute, Kans., independent, vice president for eastern Kansas; and **Rayburn L. Foster,** Phillips Petroleum Co., vice president for northern Oklahoma. **William F. Latting,** Tulsa, who has been acting executive vice president of the association, was elected to this post. **William O. Pitts,** Oklahoma City, was named assistant secretary. New

members of the division's executive committee include Abernathy; Latting; Merrick; and **Glen E. Armour,** Tenneco Oil Co., Great Bend, Kans.; **W. B. Berwald,** Ohio Oil Co., Tulsa; **John W. Brice,** Humble, Tulsa; **E. F. Bullard,** Pan American Petroleum Corp., Tulsa; **D. L. Connelly,** Warren Petroleum Corp., Houston; **Harry P. Conroy,** Halliburton Co., Duncan, Okla.; **A. O. Detmar,** Mobil Oil Co., Denver; **C. H. Glidden,** Union Oil Co., Tulsa; **W. H. Morris,** Sinclair Oil & Gas Co., Tulsa; **J. J. Mullane,** Humble, Oklahoma City; **C. W. Paine,** Western Supply Co., Tulsa; **R. R. Phillips,** Sinclair Refining Co., Kansas City; **O. F. Sebesta,** Texaco, Tulsa; and **W. E. Schoeneck,** British-American Oil Producing Co., Dallas.

L. M. Snyder, vice president and general manager of relations and local sales for Arabian American Oil Co., has been named vice president, operations. Snyder will continue as chairman of Aramco Overseas Co. **D. N. Ezzell,** acting assistant general manager of relations and local sales, has been named general manager of this department. **H. J. McDonald,** acting general manager of government relations organization, has taken over this post permanently. **R. H. Devenney,** coordinator of the personnel division, industrial relations department, in Aramco's general office, has been named assistant general manager of relations and local sales. Also, **G. F. Larsen,** general superintendent of the oil operations department in Abqaiq, Saudi Arabia, has been named assistant district manager, Abqaiq.

Jerome D. Novotny, division geophysicist in Pan American Petroleum Corp.'s Houston office, has been appointed Corpus Christi, Tex., district exploration superintendent. He succeeds **C. H. Houston,** who is moving to the Houston division office.

T. A. Halbrook has joined GeoData Corp. as seismologist. He will headquarter in Tulsa.

H. Jack Naumann, Humble, has been elected president of Houston Association of Petroleum Landmen. He succeeds **James E. Etheridge,** Michel T. Halbouty interests. Other new officers include **Arthur E. Smith, Jr.,** Continental Oil Co., first vice president; **P. F. Haberstick,** Atlantic Refining Co., second vice president; **Ralph S. O'Connor,** Herman and George R. Brown, third vice president; **W. E. Belt,** Texas Eastern Transmission Corp., secretary; and **R. S. Terry,** Shell Oil Co., treasurer. New directors are **Dean Chapman,** Mobil Oil Co.; **W. James Wooten,** Texas Gas Exploration Corp.; **G. Milton Hughes,** Union Texas Natural Gas Corp.; and **J. Phil McGowan, Jr.,** Transcontinental Gas Pipe Line Corp.

James W. Bateman, assistant manager of Continental Oil Co.'s Lake Charles, La. refinery, has moved up to manager. He succeeds **J. M. Jones,** who recently retired. Bateman has been with Conoco since 1952. He was assistant manager of the coordinating and planning department, Houston, before moving to Lake Charles in 1960. **Oswald Newell, Jr.,** process superintendent of the Denver refinery, has been promoted to superintendent, Denver. He succeeds **Charles Morgan,** who has retired. Newell has been with Conoco since 1948 and had been process superintendent in Denver for the past 3 years.

BATEMAN

Frank F. Fisk, Subsurface Studies, Inc., Dallas, is president of Togo-American Oil Co., new Dallas firm which has just received a 1.2-million-acre concession for exploration in the Republic of Togo on the western coast of Africa. **Allan Shivers,** former Texas governor, is chairman of Togo - American. Other officers are **H. L. Howard,** executive vice president; and **E. C. Fox, Jr.,** secretary - treasurer. Directors are Fisk, Shivers, Howard, Fox, **George Marsh,** Austin, Tex., and **Gary Morrison,** Austin.

DEATHS

Emerson M. Butterworth, 67, retired vice president of California Texas Oil Corp., died December 3 at his home in San Francisco. Butterworth was with Standard Oil Co. of California and its affiliates for 43 years before his retirement last year. He was president of American Overseas Petroleum Co., before becoming a vice president of Caltex. During World War II Butterworth was a special representative for the Petroleum Administration for War.

Harold F. Clary, 63, senior vice president, a director, and general counsel of Signal Oil & Gas Co., died December 1 in Los Angeles. Clary had been with Signal since 1932.

Wiley B. Hissom, 68, retired president of Hissom Drilling Co., died December 6 in Tulsa after suffering a heart attack. Hissom, who was honored at the 1959 International Petroleum Exposition as "Grand Old Man of Drilling," had been retired since 1949. He entered the oil industry in the early days in West Virginia, working for South Penn Oil Co. and other companies. In 1917 he moved to Oklahoma and, by 1921, he was drilling with own cable tools in the area.

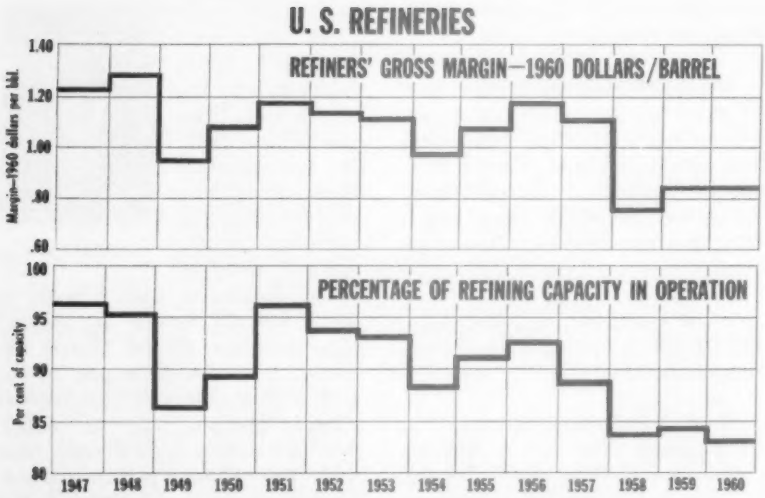
Jess B. Bollinger, 64, pioneer Alice, Tex., oil man, died November 27 in an Alice hospital after a long illness.

Beal W. Shankland, 87, retired production superintendent with the Standard Oil Co. (N. J.) companies, died November 23 in a Marietta, Ohio, hospital. Shankland did development work for Jersey in Spain, France, and North Africa before being named production superintendent in Louisiana. He retired in 1934.

Arthur Denny Dooms, 69, retired manager of Gulf Oil Corp.'s right-of-way and claims department in Tulsa, died November 30 in a Tulsa hospital. Dooms retired in 1956 after 40 years with Gulf.

Randall Ryder Morton, 45, Tulsa independent operator, died December 1 at his home in Tulsa of a heart ailment.

Statistics



WHEN REFINERS have to operate refineries above 90% of capacity to meet demands, product prices move up and gross margins increase. Chart 1.

Needed: Firm application of "K" factor to sales forecasts

. . . to cure today's oversupply and improve prices.

So believes Cities Service's Vice President Frame.

IF PRESENT TRENDS continue unchecked, the oil industry faces at least 5 more years of unsatisfactory product prices and earnings.

But top management can cure today's oversupply and improve price levels by one simple, but important, step:

Apply a "K" factor to company sales forecasts—and resulting refinery-runs schedules—to cut production down to a realistic figure.

That's the advice of A. P. Frame, senior vice president and a director of Cities Service Co., to members of the American Petroleum Institute board of directors.

Frame noted that the "K" factor is really more necessary when the nation's refineries are operating at a lowered percentage of capacity. It doesn't seem so necessary when refineries are operating around 90% of capacity.

Profit vs. capacity. Refinery realization increases with percentage of refining capacity operated—and in this truism lurks a genuine danger.

This relation of realization to capacity is shown in Chart 1 where two graphs cover the 14-year period from 1947 through 1960. The bottom line shows percentage of total domestic refining capacity in operation each year. The upper line measures gross refinery margin per barrel of crude run. The gross margin is expressed in 1960-value dollars.

The percentage of total refining capacity in operation ranges from a high of 96% in 1947 to a low of 83% in 1960. Any increase in product demand tends to increase the percentage of refinery capacity in operation. On the other hand, construction of new refining capacity tends to decrease this percentage figure.

The gross margin in the upper line was calculated from conventional refinery yield patterns of the major products and posted wholesale prices for these products minus cost of crude oil.

Changes in the level of the gross-margin figure are a good measure of the profitability of refinery operations. In the end it also is a major factor in determining changes in the corporate earnings of domestic integrated oil companies.

No accident. The charts are alike at too many points for their similarity to be in any way accidental.

The high points on the operating line correspond to high points on the gross-margin line. The same is true for low points. Even the intermediate points show a corresponding relationship.

Frame, in noting this, commented: "In looking at these two graphs, one is forced to the conclusion that historically refinery margins for any one year, and consequently the annual earnings of domestic integrated oil companies, have been directly proportional to the percentage of refinery in operation for that year."

He called attention to the low margins and low operating percentages in 1949 and 1954. Both of these depressed periods were of

A quick look at the highlights . . .

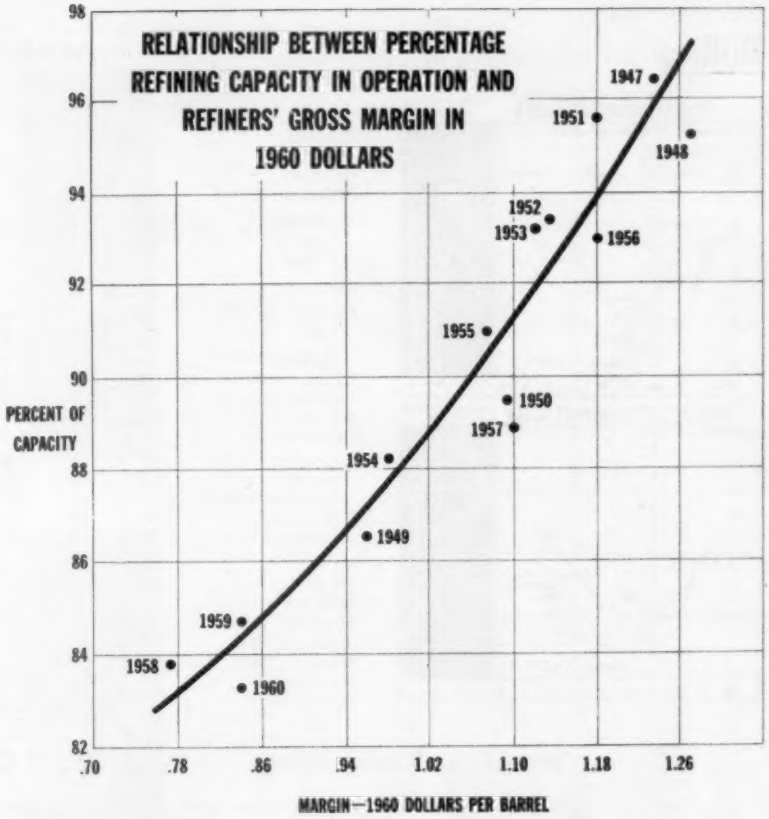
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,181,140	DOWN	11,390	UP	175,480
Crude stocks	248,800,000	DOWN	2,108,000	UP	12,017,000
Completions	985	UP	165	UP	69
Refinery runs	8,518,000	UP	215,000	UP	684,000
Gasoline stocks	186,234,000	UP	2,528,000	DOWN	1,008,000
Kerosine stocks	36,102,000	DOWN	528,000	DOWN	800,000
Distillate stocks	173,761,000	DOWN	3,782,000	UP	1,119,000
Residual stocks	47,532,000	DOWN	1,200,000	DOWN	1,807,000
Four-product stocks	443,629,000	DOWN	2,982,000	DOWN	2,496,000
Total imports	1,807,000	DOWN	16,400	UP	153,100

short duration—about a year each. They also were followed by sharp increases. Rebounding from the 1949 drop, demand for products increased 12% in 1950. The recovery from the 1954 low point showed up as substantial gain of 8.5% in 1955.

"The present situation is much worse," Frame observed in comparing earlier short dips in the curves with continued low levels in recent years.

"The rate of growth in demand has dwindled to the order of 2% a year. Enough new capacity has come into operation so that for 1961 we will do well to be operating our U. S. refineries at 82% of capacity. If no new refining capacity is commissioned and if product demand continues to grow at a 2% annual rate, it will be 1966 before U. S. refineries will be operating above 90% of capacity."

And the charts show that refinery margins have been at reasonable levels only when refineries operated above 90% of capacity.



VERTICAL POSITION of each point shows per cent of capacity operated during year. Horizontal position gives refiner's gross margin. All points hang close to trend line. Chart 2.

More proof. The curve in Chart 2 shows mathematically how much refinery margins have decreased as percentage of operating capacity decreased.

Each point represents a year with refinery margins measured on the X-axis and percentage of refinery capacity in operation on the Y-axis.

If the refiner can discover what refinery practices produce the smooth curve, he has a better chance to select a cure for his sick market.

His troubles usually follow this course: High runs can mean overproduction. Overproduction brings high inventories. High inventories influence product prices. And product prices change refinery margins.

Chart 2 shows that the degree of overproduction is the lowest when refineries are operating at 95% of capacity or over and is the greatest when operations drop to 80% of capacity or lower.

It's easily understood why a slight overprograming of refinery runs is a natural tendency. Integrated oil companies schedule refinery operations as part of a supply program to which all departments contribute. Crude departments want increased markets for crude. Refiners want to run all the crude they can because their unit cost will be lower. Marketers always are optimistic about the amount of products they can sell.

But this optimism will not account for the relationship shown in Chart 2. Frame's explanation: Refinery upsets inevitably occur and are not subject to scheduling. Who can tell when a plant will be plagued by water and power failures, weather, mechanical breakdowns, labor troubles, or a host of other troubles?

When nearly all the refineries in the U. S. are scheduled to operate at about 95% of capacity, it's difficult for them to make up runs lost by plant trouble. The result is that schedules will be undershot by a substantial margin.

But when crude runs are scheduled at about 80% of capacity, it's a different situation. Even with the same number of plant upsets, there's enough idle capacity to make up the loss in throughput.

Thus two axioms emerge: The degree of refinery overproduction is an inverse ratio to the percentage of refinery capacity in operation. And the pressure on product prices is a direct ratio to the degree of overproduction at the refinery.

On the average, excess runs in the programs may not have been more than 1 or 2%, but they consistently were overstated.

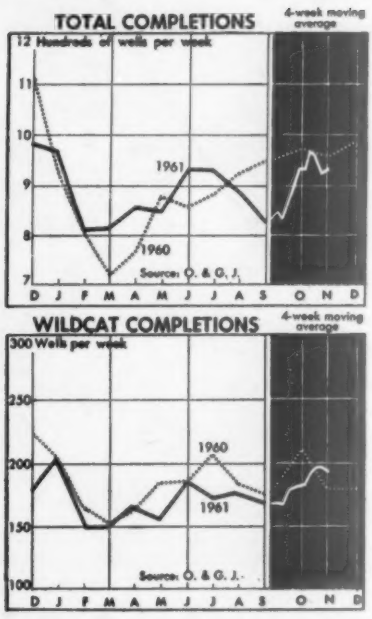
What's needed. The question then is how to correct for overstatement of product requirements for a given year.

Frame suggests that the forecasting machinery be left alone and the correction be made by chief executive officers of the oil companies. Each management could apply a reducing "K" factor to its normally prepared schedule of crude runs.

This management factor, Frame explained, would not depend on comparative crude runs of previous periods or on variations in the company's inventory position.

"Instead, it is a simple admission, based on record, that each and every oil company historically and consistently overstates its forward crude-run schedule and that the arbitrary correction of this overoptimism can best be carried out by the chief executive officer of each company."

Drilling



Active rotary rigs

	12-4-61	11-27-61	12-5-60
Alabama	7	7	6
Alaska	9	9	8
Arkansas	18	15	10
Arizona	2	2	1
California	120	112	69
Land	115	107	67
Offshore	5	5	2
Colorado	39	33	34
Florida and Ga.	1	1	5
Land	0	0	4
Offshore	1	1	1
Illinois	42	44	34
Indiana	7	7	8
Kansas	122	99	129
Kentucky	4	4	7
Louisiana	293	302	278
North	32	44	36
S. Inland waters	114	110	101
S. Land	86	90	88
Offshore	61	58	53
Michigan	21	24	31
Mississippi	68	68	47
Missouri	0	0	1
Montana	27	25	24
Nebraska	29	30	23
Nevada	1	1	0
New Mexico	105	106	116
New York	3	2	2
North Dakota	16	18	10
Ohio	8	7	5
Oklahoma	216	196	212
Pennsylvania	10	7	12
S. Dak. and Tenn.	0	0	2
Texas	673	640	650
S. Inland waters	15	15	7
S. Land	192	173	177
Offshore	3	3	2
North	58	66	59
Panhandle	55	43	60
East	63	66	53
West Central	165	168	168
West	122	106	124
Utah	36	44	33
Wash., Wis.	1	1	2
West Virginia	14	14	6
Wyoming	72	73	70
Total U. S.	**1,964**	1,891	1,835
Cum. avg. to date	1,746	1,741	1,741
Western Canada	145	135	153
Eastern Canada	0	1	0
Grand total	2,109	2,027	153

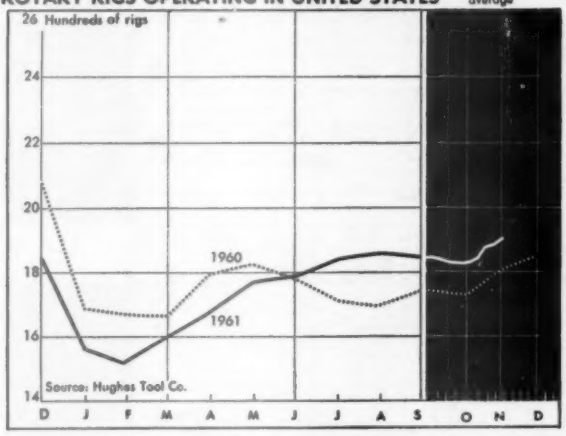
Hughes Tool Co. report.

Weekly well completions . . . Week ended December 2, 1961

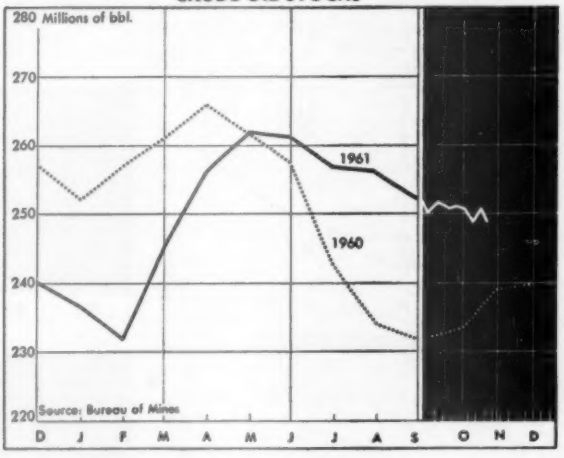
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	19	11	0	1	6	1	75,504	492	562	3	0	0	0	3	102	141
California	47	44	0	3	0	0	138,591	1,722	1,583	0	0	0	0	0	249	284
Colorado	13	3	0	1	9	0	61,141	616	613	8	2	0	0	6	276	308
Illinois	45	22	0	0	20	3	92,303	1,901	2,175	10	2	0	0	8	444	461
Indiana	23	9	0	0	14	0	40,440	728	986	4	0	0	0	4	198	347
Kansas	135	64	0	5	57	9	332,303	4,404	3,841	21	5	0	1	15	812	974
Kentucky	25	9	0	0	15	1	33,272	1,659	2,035	5	1	0	0	4	121	213
Louisiana	115	44	0	16	55	0	822,307	3,657	3,383	26	0	0	1	25	630	514
North	59	14	0	6	39	0	206,139	1,569	1,331	21	0	0	1	20	313	251
South	30	16	0	6	8	0	336,670	1,589	1,591	4	0	0	0	4	265	232
Offshore	26	14	0	4	8	0	279,498	499	461	1	0	0	0	1	52	31
Michigan	23	2	0	3	18	0	78,023	763	873	14	0	0	0	14	275	237
Mississippi	11	3	1	1	6	0	100,882	525	627	5	0	1	0	4	184	243
Montana	6	4	0	0	2	0	31,968	373	317	2	0	0	0	2	172	150
Nebraska	17	5	0	0	12	0	80,037	912	810	10	2	0	0	8	456	357
New Mexico	39	27	0	4	8	0	212,984	1,677	1,721	6	2	0	0	4	274	240
West	14	8	0	4	2	0	84,268	727	628	1	1	0	0	0	92	69
East	25	19	0	0	6	0	128,716	950	1,093	5	1	0	0	4	182	171
North Dakota	5	1	0	0	4	0	38,697	239	266	0	0	0	0	0	67	79
Ohio	24	14	0	3	7	0	56,608	997	993	1	0	0	0	1	41	47
Oklahoma	89	45	2	10	26	6	342,906	5,290	4,348	4	2	0	0	2	484	660
Texas	304	159	0	34	102	9	1,258,712	13,358	14,374	53	3	0	0	50	2,862	2,937
District 1	17	6	0	0	11	0	42,847	854	1,039	5	0	0	0	5	328	369
District 2	10	5	0	3	2	0	65,444	706	698	2	0	0	0	2	214	172
District 3	37	19	0	6	12	0	265,282	1,087	1,082	9	0	0	0	9	228	208
District 4	14	8	0	1	5	0	63,934	1,109	988	3	1	0	0	2	311	273
East	24	12	0	4	8	0	135,758	1,066	1,218	4	0	0	0	4	274	250
District 7-B	35	19	0	2	13	1	125,491	1,637	2,030	8	1	0	0	7	453	575
West	73	51	0	2	15	5	322,857	3,351	3,669	9	1	0	0	8	660	575
District 9	69	33	0	1	34	1	149,634	2,467	2,683	11	0	0	0	11	274	460
District 10	25	6	0	15	2	2	87,465	1,081	967	2	0	0	0	2	120	55
Utah	2	1	0	0	1	0	14,651	219	223	1	0	0	0	1	101	86
West Virginia	32	3	0	25	4	0	84,311	968	791	0	0	0	0	0	7	9
Wyoming	8	3	0	1	4	0	43,671	899	990	3	1	0	0	2	349	400
Miscellaneous*	3	1	0	0	2	0	17,763	1,237	1,203	2	0	0	0	2	249	218
Total U. S.	**985**	474	3	107	372	29	3,957,074	42,636	42,714	**178**	20	1	2	155	8,353	8,905
Previous week	820	387	5	93	308	27	3,927,615	.....	.....	166	17	0	2	147	.....	.....
Cum. 1961	42,636	19,159	726	4,441	15,524	2,786	174,522,333	.....	.....	8,353	747	82	367	7,157	.....	.....
Cum. 1960	42,714	19,340	1,229	3,590	16,116	2,439	175,618,841	.....	.....	8,905	809	99	302	7,695	.....	.....
Western Canada	33	16	0	11	6	0	172,032	2,142	2,106	7	3	0	1	3	491	549

*Arizona, Nevada, Alaska.

ROTARY RIGS OPERATING IN UNITED STATES 4-week moving average



CRUDE-OIL STOCKS



Crude-oil stocks by states of origin*

(Thousands of barrels)

	11-25-61	11-18-61	11-26-60
Pennsylvania	2,324	2,275	2,344
Other Appalachian	1,429	1,394	1,299
Illinois, Indiana, Michigan	9,577	9,446	9,009
Nebraska and North Dakota	3,291	3,060	2,889
Kansas	9,425	9,476	8,956
Oklahoma	17,071	17,621	15,197
Arkansas	1,751	1,616	1,853
Louisiana	19,778	19,831	18,448
North	3,502	3,253	3,247
South	16,276	16,578	15,201
Mississippi, Alabama, Florida	3,685	3,676	2,051
New Mexico	10,587	10,766	8,292
Texas	104,634	105,497	98,598
East Texas	8,013	8,003	7,422
West Texas	47,313	47,313	46,386
Texas Gulf	18,604	18,928	17,324
Other Texas	30,704	31,253	27,466
Wyoming	16,043	16,403	16,397
Other Rocky Mountain	9,791	10,214	10,210
California	22,880	23,599	25,582
Foreign	†16,534	16,034	15,658
Total	**248,800**	250,908	236,783

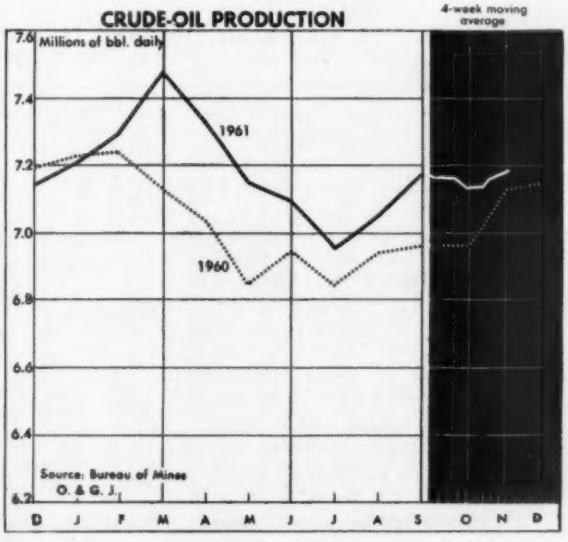
*Bureau of Mines. †Includes 4,840,000 bbl. in California.

Daily average production for week

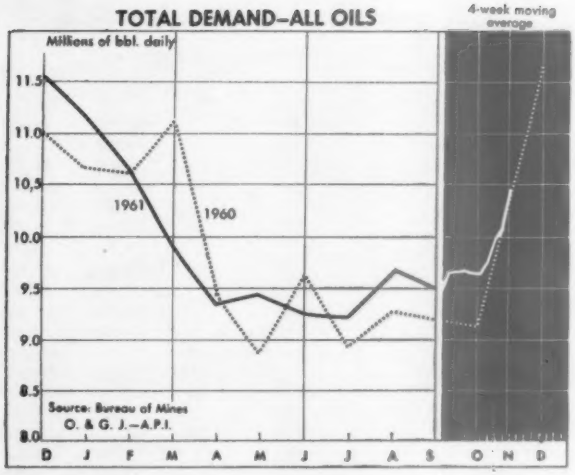
	December 2, 1961 Crude oil	Lease condensate	Total	Nov. 25 total
Alabama	18,750	.....	18,750	18,750
Alaska	26,200	.....	26,200	26,000
Arkansas	78,900	150	79,050	79,050
California	818,400	.....	818,400	817,800
Colorado	126,400	.....	126,400	126,100
Eastern	40,300	.....	40,300	41,100
Florida	1,000	.....	1,000	1,000
Illinois	221,400	.....	221,400	221,100
Indiana	30,800	.....	30,800	30,800
Kansas	†296,640	.....	†296,640	†302,930
Kentucky	49,800	.....	49,800	51,400
Louisiana	1,047,500	164,900	1,212,400	1,210,750
North	113,000	16,500	129,500	129,850
South	934,500	148,400	1,082,900	1,080,900
Michigan	52,600	.....	52,600	52,600
Mississippi	146,000	4,200	150,200	152,200
Montana	88,900	.....	88,900	87,100
Nebraska	71,250	.....	71,250	71,000
Nevada	450	.....	450	450
New Mexico	310,000	9,000	319,000	319,000
North Dakota	58,400	.....	58,400	58,750
Oklahoma	†458,100	.....	†458,100	†506,200
Texas	2,460,600	95,750	2,556,350	2,523,800
Dist. 1	42,400	3,000	45,400	45,900
Dist. 2	107,000	8,200	115,200	114,000
Dist. 3	308,000	38,600	346,600	344,000
Dist. 4	179,000	14,000	193,000	191,000
Dist. 5	26,200	900	27,100	26,850
Dist. 6	119,000	8,700	127,700	125,500
East Texas field	130,000	.....	130,000	128,000
Dist. 7-B	120,000	550	120,550	120,500
Dist. 7-C	109,000	3,700	112,700	110,550
Dist. 8	1,020,000	13,000	1,033,000	1,013,000
Dist. 9	195,000	3,000	198,000	197,500
Dist. 10	105,000	2,100	107,100	107,000
Utah	95,400	.....	95,400	90,500
Wyoming	408,500	.....	408,500	405,300
Others	‡850	.....	‡850	‡850
Total U. S.	6,907,140	274,400	**7,181,140**	7,192,530
Change from prev. week, down			**11,390**	
Canada	†659,700	†10,100	†669,800	†680,300
Total U. S. prod.—Jan. 1-Dec. 2				§2,410,601,000
Same period last year (crude plus cond.)				*2,317,583,800 bbl.

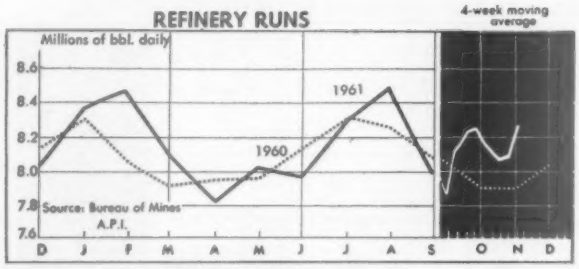
*Includes 74,599,400 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Arizona, Missouri. §Revised.

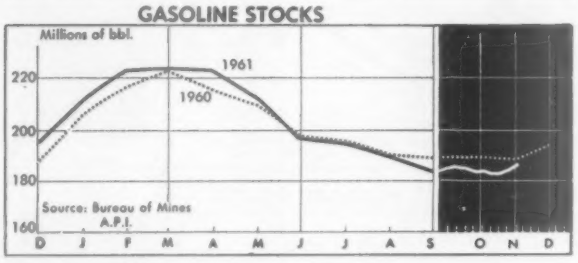
CRUDE-OIL PRODUCTION 4-week moving average

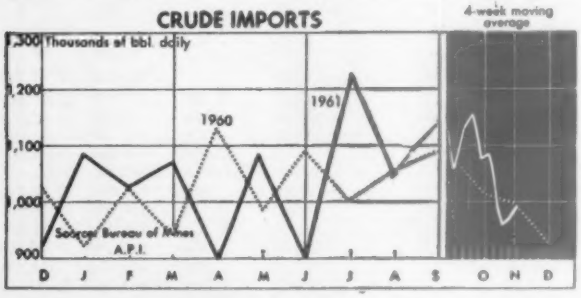


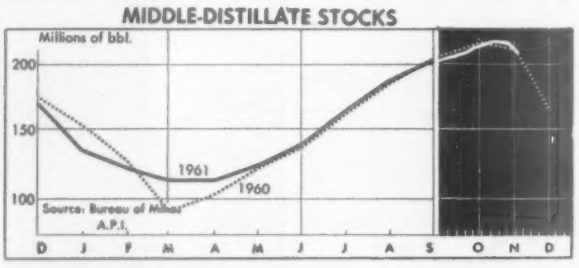
Refining

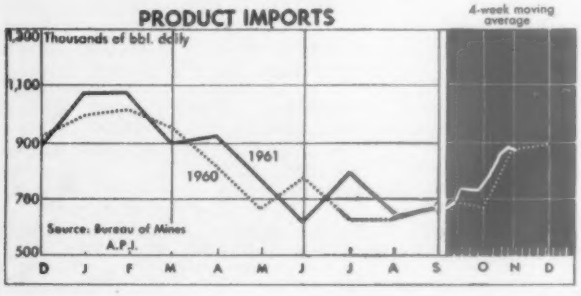


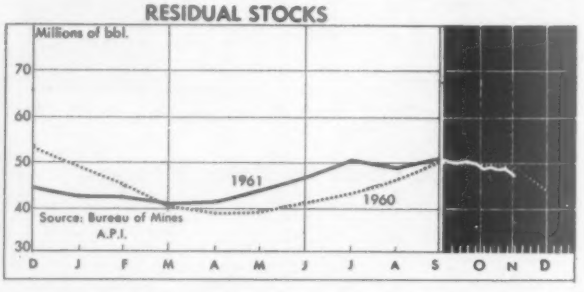












API refinery report—December 1, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,200	544.9	26.3	402.0	125.6	43,556	14,550	70,778	13,796	1,062	503.8	34.1	332.7	145.4
Appalachian:														
District 1	108	44.4	5.6	23.3	15.1	5,383	783	4,348	432	98	39.9	4.1	19.9	11.8
District 2	92	55.6	7.9	18.3	12.9	3,059	498	1,855	234	102	52.7	7.2	18.7	12.4
Ind., Ill., Ky.	1,580	818.1	87.3	378.0	217.2	30,786	7,091	29,045	5,765	1,429	735.5	80.4	313.5	167.4
Minn., Wis., Dak.	115	55.4	7.9	26.0	15.4	6,996	1,877	8,450	583	115	55.0	5.3	27.1	22.0
Okla., Kans., Mo.	742	433.1	21.8	188.7	19.3	16,895	1,691	13,437	973	706	410.9	11.0	176.5	19.3
Inland Texas	305	209.7	15.0	48.9	18.7	7,025	602	1,614	2,819	274	214.6	9.7	45.3	18.7
Texas Gulf Coast	1,949	1,003.2	143.8	527.4	114.7	24,564	3,258	16,597	4,775	1,881	968.9	140.1	457.8	135.7
La. Gulf Coast	745	395.9	54.9	173.9	40.0	9,376	1,887	7,368	1,110	645	358.7	73.0	143.5	39.9
N. La. and Ark.	112	66.6	6.4	22.1	5.7	6,438	1,057	2,927	203	108	68.2	5.8	21.4	7.3
Rocky Mountain:														
New Mexico	26	14.4	0.4	4.4	2.1	775	59	229	105	22	11.7	0.3	3.9	2.7
Other Rocky Mt.	291	144.4	7.3	70.0	32.0	5,410	550	2,434	1,181	280	140.9	3.5	67.7	33.6
West Coast	1,253	653.7	56.3	237.7	301.0	25,971	2,199	14,679	15,556	1,171	527.9	38.9	201.3	287.6
Dec. 1, 1961	8,518	4,439.4	440.9	2,120.7	919.7	186,234	36,102	173,761	47,532	7,893	4,088.7	413.4	1,829.3	903.8
Nov. 24, 1961	8,303	4,220.4	448.3	1,963.9	907.4	183,706	36,630	177,543	48,732	.....	.....	.....	.....	.....
Dec. 2, 1960	7,834	4,150.4	393.6	1,847.7	958.7	187,242	36,902	172,642	49,339	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES

Gravity schedule

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver-Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	†$2.35	$2.61	$2.29	$2.95	$2.90	‡$2.38	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.40	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.42	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.44	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.46	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.48	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.50	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.52	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.54	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.56	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.58	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.60	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.62	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.64	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.66	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.68	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.70	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.72	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.74	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.76	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.78	2.95

*Cooke, Grayson, Montague. †Other posting starts at $2.55. ‡Some at 2.58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.10-3.25
Conroe	3.23-3.53
Van	2.93-3.08
Pennsylvania Grade:	
Bradford	$4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**3.00**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34,9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41°-41.9°, Umm said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.63
Redwater (Alta.)	2.52
Weyburn (light)	2.185
Midale C	1.89
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Price for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS+10%)	$3.14
★ Carib.-NY, dirty (ATRS−52.5%)	1.31
★ Carib.-Rotterdan, clean (Scale−31%) (22s. 9d.)	3.19
★ PG-Japan, dirty (USMC−73%)	2.75
PG-NY, dirty (USMC−70%)	3.81

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refinenrs' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	10.25-11.50
★ Premium (99 octane)	13.00-14.25
†Natural gasoline (26-70)	4.5
†Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.50-11.00
Regular (92 octane)	10.75-11.25
Premium (98 octane)	11.75-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.20
Premium (94 octane)	12.20
Premium (100 octane)	13.35
Caribbean area (cargoes):	
Regular (87 octane)	9.00
Premium (97 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.50- 9.75
Distillate No. 1	9.50- 9.75
Distillate No. 2	8.75- 9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.75
Distillate No. 2	8.75
New York Harbor (barges):	
Kerosine 42-43	11.20
Distillate No. 2	10.20
Diesel fuel, 48-52 d.i.	10.35
Caribbean area (cargoes):	
Distillate No. 2	8.10

RESIDUAL FUEL

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.65-1.75
Gulf Coast (cargoes):	
Bunker C fuel	2.20
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C fuel	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

†Due to the decline in market for Grade 26-70 natural gasoline, The Oil and Gas Journal will discontinue publication of prices for this grade of natural gasoline at the end of 1961.

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EXCEPT . . .

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FRANKS 2000 trailer mounted drill, GMC Diesel, 1958 IHC twin screw tractor, KB8 tractor, Chevy winch truck, 2 tandem trailers, 4,000 ft. 2⅞ drill tubing, 300 ft. collars, dog house, light plant, etc.—$32,000.00. Sell separately. M. H. Collum, 2011 Glenarm, Denver, Colorado, KE4-0253.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

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Good No. 2 Pipe, Lapweld, SRL
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EXCELLENT 10,000 USED RIG!

U-40 w/3 - Climax VU-280 power; Ideco 133' mast w/9' subs., 5' high engine sub-base; 16" GXP and 14" FXK slush pumps; 20½" Table; BJ-4200 Triplex Hook; 66" streamlined trav. block; Emsco 'H' swivel; all other rotary accessories—9000 ft. 4½" 16.60# 'E' drill string, 33-drill collars.

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Phone POplar 3-3585

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90,000 feet
of 8⅝" O.D. 28.55#
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FOR SALE: Two U-15s, excellent condition, complete in every detail. Inventory and price on request. Box M-661, The Oil & Gas Journal, Tulsa, Oklahoma.

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Dismantled, Matchmarked For
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2—5', 44" diam. Absorbers 500#
4—150# Towers 18", 3' diam.
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40—500 through 4000 sq. ft. shell and tube St. and Adm. tube
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50—Centrifugal pumps up to 1540 gpm and 3700' head
1—Carrier refrigeration compressor, 400 ton
1—Clark centrifugal compressor, 10,000 CFM, 240# discharge
3—Clark compressors RA 3, RA 6

MISCELLANEOUS
3—Petrochemical furnaces, 1 mil., 5 mil., 7 mil., BTU/hr.
1—Flare stack, 72'

—WIRE—PHONE—WRITE—

BRILL EQUIPMENT COMPANY
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35—65 JABEZ STREET, NEWARK 5, N. J.

FOR SALE EQUIPMENT

FAILING 2500, 58' mast, 5 x 8 pump, drill pipe, collars, core barrels. Fred Butler, Box 481, Pueblo, Colo.

PORTABLE DRILL RIG
Mounted on 1955 Jeep Pick-up. $1,375. 648 26th St., Manhattan Beach, Calif. FRontier 9-9323.

FOR SALE—Compressor Cylinders. 4—Ingersoll Rand 26" & 26" x 14" 62KVG—1, Price $2000.00 each. 5 Heat exchangers 20' 5" Overall Length 51" diameter, 284—1½" OD steel tubes. Shell working pressure 240# test 412#. Tubes working pressure 175# test 350#; Price $3000.00 each. All types refinery equipment and valves. Contact: P. E. Pendergrass, Box 761, Billings, Montana; Phone 252-6327 or 245-5689.

50,000 FT. 20 inch No. 1 grade used pipe. Lengths 20 ft. square cut ends. Weight 78# to the ft. High Tensile Pipe. Indiana-Ohio Pipe Co., P. O. Box 5462 Shep. Sta., Columbus 19, Ohio. Phone CL 3-5527—CL 3-5528.

SIE, 24 TRACE, dual record, GA7-G Seismic system complete. Mounted on 1958, 2 ton Chevrolet truck, front end winch. Other equipment also available. Texas Seismograph Co. Box 2069, Phone 723-1493, Wichita Falls, Texas.

HELP WANTED

PLASTIC PIPE manufacturer wants young man (25-30) of proven sales ability with engineering degree. Telsco Industries, Box 18205, Dallas 18, Texas.

PROJECT ENGINEERS
Graduate Electrical and Civil Engineers with 5 to 8 years' experience in detail design of pipeline and plant facilities. Continued growth and diversification of this major company requires supervisory potential. Permanent position with excellent salary and benefits. Pleasant friendly city with good schools and housing. All qualified applicants will be considered regardless of race, color, creed or national origin. Submit resume with complete salary history to: J. Alan Hansen, Northern Natural Gas Company, P. O. Box 308, Omaha, Nebraska.

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Large independent producer operating 250 oil and gas wells and 2 drilling rigs in western Kansas has top-staff-level opening for a petroleum engineer.

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You should be the kind of man that can work with a team of top men in this organization without being a "yes" man. Resourcefulness in solving problems under difficult conditions is needed at times.

Starting salary will be in the neighborhood of $12,000 per year, but the ceiling of opportunity is unusually high and the right person will enjoy a material increase in income. You could become an executive in the organization if you have the ability and motivation.

All applications will be treated with extreme confidence. Write letter giving complete and continuous employment history, present salary, education and marital status. Write to Bentley Barnabas, Associated Personnel Technicians, Inc., 118 S. Main, Wichita, Kansas.

HELP WANTED

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Tulsa, Oklahoma

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EAST TEXAS, N. La., Mississippi Districts Originate and evaluate wildcat and development prospects. Competent geologist, retainer of interest. Box M-663, The Oil and Gas Journal, Tulsa, Oklahoma.

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U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Division of Field Services, Washington 25, D. C. Notice is hereby given that the Government's undivided one-half mineral interest in an area of 81.19 Acres (gross), or 40.595 Acres (net), within the known geologic structure of Roxie Field, Mississippi, will be offered for oil and gas leasing in one parcel through sealed bids to the qualified bidder of the highest cash amount per net acre, at 1:00 p.m., E.S.T., December 20, 1961, when bids will be opened. Full details of the lease offering and how and where to submit bids may be obtained from the Manager, Land Office, Division of Field Services, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Division of Field Services, Washington 25, D. C. Notice is hereby given that two parcels of land containing a total of 119.09 acres, Parcel 1 within the undefined known geologic structure of Pine Island field and Parcel 2 within the undefined known geologic structure of Monroe Gas field, Louisiana, will be offered for oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre, at 1:00 p.m., E.S.T., December 27, 1961, when bids will be opened. Full details of the lease offering and how and where to submit bids may be obtained from the Manager, Land Office, Division of Field Services, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

LEGAL

THE FOLLOWING announcement is made by virtue of the powers vested in the Ministry of Finance by Order No. 1 of 1943, as amended. 1. The areas situated within the boundaries of District 1 and District 2 as described below are declared as "open" for the submission of proposals for the award of petroleum concessions therein for a period of three (3) months from Dec. 5th, 1961 ("zero date"). 2. (a) Boundaries of District 1: Commencing at the intersection of latitude 16° North and longitude 41° 20′ East; thence South along longitude 41° 20′ East in a straight line to the intersection of latitude 14° 45′ North and longitude 41° 20′ East; thence West along latitude 14° 45′ North to the intersection of latitude 14° 45′ North and longitude 40° East; thence in a North-Westerly direction in a straight line to the intersection of latitude 15° 35′ North and longitude 39° 15′ East; thence in a North-North-Westerly Direction to the intersection of latitude 16° North and longitude 39° 05′ East; thence East along latitude 16° North to the point of origin, the area enclosed in said boundaries being approximately 27,500 square kilometers in area. (b) Boundaries of District 2: Commencing at the intersection of latitude 18° 10′ North and longitude 38° 45′ East; thence in a South-South-Easterly direction to the intersection of latitude 17° 12′ North and longitude 39° 14′ East; thence East along latitude 17° 12′ North to the intersection of latitude 17° 12′ North and longitude 39° 41′ East; thence South-East in a straight line to the intersection of latitude 16° North and longitude 41° 21′ East; thence West along latitude 16° North to the intersection of latitude 16° North and longitude 39° 05′ East; Thence North-North-Westerly in a straight line to the intersection of latitude 17° 30′ North and longitude 38° 40′ East; Thence North-North-Westerly in a straight line to the border between the Empire of Ethiopia and Republic of Sudan; thence along said border to the coast of the Red Sea; thence in a North-Easterly direction in a straight line to the point of origin, the area enclosed in said boundaries being approximately 27,000 square kilometers in area. 3. Any company ("applicant company") desiring to submit a proposal or proposals looking to the award of a concession covering either or both of the Districts described above shall notify the Ministry of Mines in writing. Upon said notification, and against payment of U. S. $1,000 for each District with respect to which requested, the applicant company shall be furnished with all documents required to permit the preparation of a proposal including a form of Contract of Concession, and instructions relating to the procedure to be followed in submitting proposals, and other documents. In addition, information as to exploration activities already carried on within each such District shall be made available to the applicant company. 4. Prior to ("zero date plus three months") proposals may be filed by the applicant company in accordance with the prescribed procedure. All proposals filed before (above date) shall be deemed to be filed simultaneously but shall not, however, create or vest any right in the applicant company, the Imperial Ethiopian Government reserving full right to reject any and all proposals received without cause. 5. All proposals shall be opened in public on ("zero date plus three months and one day"). Address: Ministry of Mines, P. O. Box 486, Addis Ababa, Ethiopia. Ministry of Mines, Imperial Ethiopian Government.

Discoveries

(Continued from Page 141)

Kansas

Barton County:

Nadel & Gussman and Thunderbird Drilling Co. 1 Wood, NW NW NW 25-19s-13w, 2 miles east of Great Bend. IPF 239 BOPD, no water, 37.6°, Arbuckle open hole 3,414-18 ft. TD 3,418 ft. New oil discovery.

Comanche County:

Continental Oil Co. 1 C. F. Biddle, C NE NE 13-33s-17w, 4 miles northeast of Beals pool, 10 miles southeast of Coldwater. IPF 2,500 M.c.f.d., Miss. 5,104-46 ft. TD 5,831 ft. Gas discovery.

Mississippi

Adams County:

Griffin & Keary 1-B U.S.A., 52-5n-1w. IP 67 BOPD, 30°, TP 125 psi., GOR 200 cu. ft. per bbl., perf. 3,990-91½ ft., Sparta. TD 6,812 ft. Sparta-sand discovery ½ mile north of abandoned Pellucid Bayou (Wilcox) field.

Covington County:

Pan American Petroleum Corp. 1 R. L. Windham, SE NE SW 25-8n-15w. IPP 217 BOPD, 31.9°, perf. 13,126-31 ft., Mooringsport; and IPF 488 BOPD, ½-in., 41.3°, TP 900 psi., GOR 513 cu. ft. per bbl., perf 13,725-31 ft., Rodessa. TD 15,311 ft. Discovery well of Collins field.

Hinds County:

Olin Oil & Gas Corp. 1 Wolfe, 26-3n-2w. IPP 62 BOPD (net), BWPD, 16/64-in., 47°, TP 35 psi., GOR 200 cu. ft. per bbl., perf. 13,008-42 ft., Rodessa. TD 14,556 ft. Discovery well of Morgans field.

Jefferson County:

Argo Oil Corp. et al. 1 Armstrong, 37-8n-1w. IP 247.49 BOPD (net), 11.04 BWPD, 14-in., 42.9°, TP 1,100 psi. GOR 3 M.c.f. per bbl., perf. 10,076-86 ft., lower Tuscaloosa. TD 10,251 ft. Discovery well of Cannonsburg field.

Jones County:

Sinclair Oil & Gas Co. 1 Hinton, 10-9n-13w. IP 40 BOPD, ¼-in., 43.9°, TP 240 psi., GOR 870 cu. ft. per bbl., perf. 13,004-14 ft., Rodessa. TD 13,488 ft. Extends Gitano field 1 mile east.

Smith County:

Cities Service Petroleum Co. 1 Hough, 6-10n-16w. IP 2,340 M.c.f.d., 4.4 BCPD, 9/64-in., 44.4°, TP 3,450 psi., perf. 13,102-16 ft. and 13,130-44 ft., Rodessa; and 257 BOPD, 9/64-in., 44.2°, TP 1,875 psi., GOR 623 cu. ft. per bbl., perf. 13,780-92 ft., Sligo (Womack zone). TD 14,803 ft. Extension and new-segment discovery 1 mile south of Magee field.

Oklahoma

Texas County:

Cities Service Petroleum Co. 1 Stonebraker "AN," NE SW SW 9-3n-14eCM, IP 78 BOPD, 37.3°, Morrow 6,295-98 ft. TD 6,961 ft. New oil discovery.

Hugoton gas area. Anadarko Production Co. 1 Lynch "A," C NW SE 20-6n-13eCM. IPF 701 BOPD, 38°, GOR 1,193:1, Morrow 6,405-92 ft. TD 6,583 ft. PB 6,550 ft. New oil discovery.

New Mexico

Lea County:

El Paso Natural Gas Co. 1 Mescalero Ridge unit-federal, 18 miles southeast of Maljamar in 21-19s-34e. IPCAPF 1,300 M.c.f.d., plus 47.3 bbl. condensate, Morrow 13,328-40 ft.; IPF 993 BOPD, 24/64-in. choke, 38°, GOR 677:1, TP 1,179 psi., CP packer, Bone Spring 10,118-34 ft. TD 13,972 ft. Dual zone discovery.

ADVERTISERS IN THIS ISSUE

A

Ajax Iron Works 123
Allis-Chalmers 103, 104
Armco Drainage & Metal Products ... 11

B

BJ Service, Inc., A Borg-Warner Subsidiary 111
Baker Oil Tools, Inc. 40
Beckman Instrument 26
Bendix Corporation, The Scintilla Division 130
Bethlehem Steel Company 86
Bradford Motor Works 126
Brown & Root, Inc. 57
Brown & Sharpe 131

C

Cameron Iron Works, Inc. 12
Caterpillar Tractor Co. 61
Chevrolet Division of General Motors 120
Cities Service 27
Classified Advertising 152, 153, 154
Continental-Emsco Company, a Division of the Youngstown Sheet and Tube Company 32, 33

D

Daniel Orifice Fitting Company 134
Darling Valve and Mfg. Co. 23
Davison Chemical Company Division of W. R. Grace & Co. 13
De Laval Steam Turbine Company ... 38
Dover Corporation, W. C. Norris Division 37, 141
Dowell ..... 116, Inside Back Cover
Drilling Equipment Manufacturing Co. 122

E

Ethyl Corporation 53

F

Falk Corporation, The 16
First National Bank & Trust Co. of Tulsa 110
Foxboro Company, The 42

G

Goodrich Industrial Products Co., B. F. 3
Grove Valve and Regulator Company .. 4
Guiberson Corporation 36

H

Halliburton Company ..... Inside Front Cover, 8, 9, 118
Hobart Brothers Company 99
Hoke Incorporated 35
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 15

I

Ingersoll-Rand 21

J

Jones Company, The S. M. 114

L

Layne & Bowler, Inc. 25
Liberty Mutual Insurance Company .. 2
Lone Star Cement Corporation 1
Lummus Company, The 24

M

Maloney-Crawford 34
Martin, Manufacturer, John N. 117
Midwest Piping, A Division of Crane Co. 22
Mission Mfg. Company 124
Mixing Equipment Co., Inc. 14
Motorola Communications & Electronics, Inc. 117
Murphy Corporation 132

N

National Supply Company, Subsidiary of Armco Steel Corporation 137, 138, 139, 140
National Tank Company 156
Norris, W. C. Division, Dover Corporation 37, 141

O

Oil Well Supply Division 6, 7
Otis Engineering Corporation 5

P

Pipe Inspectors, Division of Plastic Applicators, Inc. 106

Q

Quincy Compressor Co. 134

R

R-P&C Valve Division American Chain & Cable Company, Inc. 133
Republic Steel Corporation 28, 29, 30
Roebling's Sons, John A., Division The Colorado Fuel and Iron Corporation 127
Ross-Martin Company 117
Royal Bank of Canada, The 17

S

Schlumberger Well Surveying Corp. .. 85
Square D Company 68
Standard Oil Company (New Jersey) .. 20
Stine Incorporated, Joe 141

T

Templeton, Kenly & Co. 134
Thomas Flexible Coupling Co. 112
Thornhill-Craver Co. 10
Tulsa Paper Company 141

U

United States Steel Corporation—Oil Well Supply Division 6, 7

W

Well Equipment Mfg. Corp. 115

Y

Youngstown Sheet and Tube Company 18, 19

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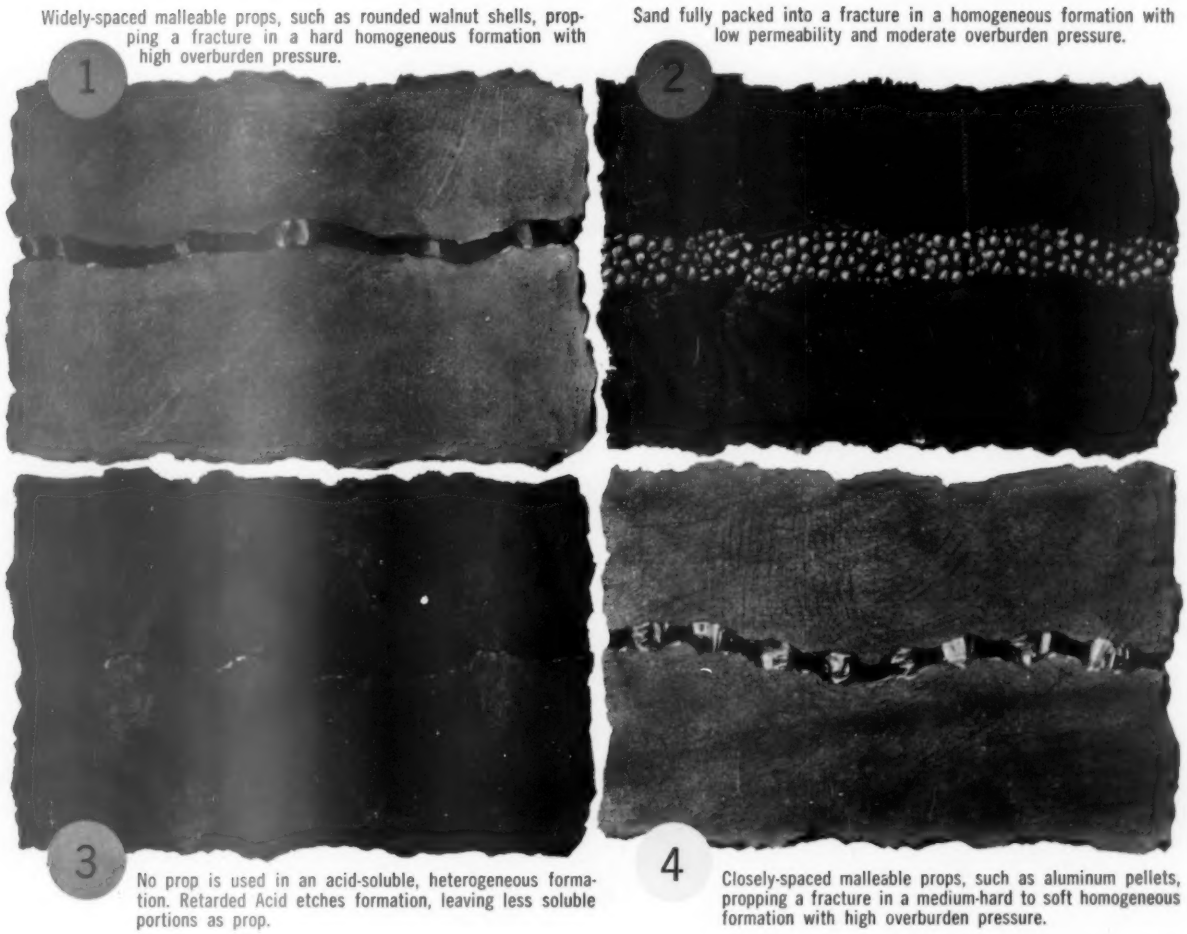

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